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ABSTRACT

This study investigated the extent of agreement between selected college-level elementary science educators (N=107) and selected fourth-,fifth-, and sixth-grade Kansas science teachers (N=256) regarding the science laboratory teaching competencies that should be possessed by these teachers. Each group was given a questionnaire which focused on operational, process, management, developmental, and evaluation items. Among the results reported are those indicating: that science teachers believe there is a somewhat greater need for competencies related to microscope use, cleaning glassware, and use of models; that science educators perceive a somewhat greater need (than teachers) for cultures in the classroom, for the use of keys (in identification), and for the use of terraria/aquaria, the metric system, histograms, and electric circuits; that teacher educators regarded all science process competencies at a higher level of need than did science teachers; that there were no differences between the groups for the management items; that hands-on approaches, individualized learning, and low budget or homemade materials were favored more by teacher educators than by teachers; and that teacher educators favored skill tests and checklists, student feedback instruments, and audio-tape techniques to a greater degree than did teachers. (The questionnaires used are included in appendices.) (Author/JN)

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A STUDY OF THE LABORATORY SCIENCE TEACHING SKILLS OF ELEMENTARY TEACHERS

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by

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A DISSERTATION

submitted in partial fulfillment of the

requirements for the degree

DOCTOR OF PHILOSOPHY

College of Education

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Manhattan, Kansas

1984

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In rememberance of my mother

Candasie H. Parham whom I loved dearly

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ABSTRACT

The objective of this research was to determine the extent of agreement between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory teaching competencies that should be possessed by these elementary teachers. The subjects were 107 college educators across the nation and 256 elementary teachers from various school districts in the state of Kansas.

Data were gathered through a survey instrument focused on demographic data and with the following competencies: operational, process, management, developmental and evaluation. The non-parametric chi square statistic was used to determine significant distributional differences between responses of teachers and teacher educators.

Of the twenty-one items identified in the category of operational competencies, nine yielded significant distributional differences. Science teachers believe there is a somewhat greater need for the three competencies of use of the microscope, cleaning glassware, and use of models. Science educators perceive a somewhat greater need (than teachers) of cultures in the classroom, use of keys (in identification), use of terraria and aquaria, use of the metric system, use of histograms, and use of electric circuits. There were not significant distribution differences between the two groups in twelve of the items.

All six items within the process competencies yielded significant distribution differences. Teacher educators regarded all six process competencies at a higher need level than did science teachers.

The four items within the management competencies did not yield significant differences between the two groups.

Of the four items within the area of developmental competencies, three produced chi square values that were significant below the .05 level. Hands-on approaches, individualized learning, and low budget or homemade materials were favored more by teacher educators than by teachers,

Of the seven items within the category of evaluation competencies, three yielded significant distribution differences. Teacher educators favored the following items to a greater degree than did teachers: Skill tests and checklist, student feedback instruments, and audio-tape techniques.

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This dissertation is dedicated to my wife, Victoria, and to our daughter Alicia Kim for their patience and understanding, and to Dr. John H. Wilson who believed in my success ever since we first met at Wichita State University.

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CHAPTER I

INTRODUCTION

In the context of our growing concern about science, the public has been vitally interested in having competent teachers in our educational system. In addition, the public assumes that all subjects are adequately taught.

Before the sixties, elementary science had always taken a back seat to other subjects. The launch of Sputnik began to focus a major emphasis on science and mathematics. The National Science Foundation developed new elementary science programs. This multimillion dollar investment developed such programs as: (SAPA) Science A Process Approach, (SCIS) Science Curriculum Improvement Study, and (ESS) Elementary Science Study. These programs brought a new emphasis in the area of science as our country slowly began to move into the space age. Teachers began taking courses, in-service training, and workshops to learn how to implement the programs in the classroom. Competency was being developed among teachers in elementary science. This "new science" carried on into the early seventies.

In the late seventies and early eighties, many government programs had to be cut because of lack of funding. The National Science Foundation had to cut its programs in elementary science. In-Service training and workshops were no longer being funded, thereby causing many school districts to discontinue some of their Federally developed science programs. In some cases, because of these financial problems, schools were changing from the hands on to the textbook approach.

The president's "Nation at Risk" report has stated," there exists a crisis in public education." The public wants a return "back to basics." Student and teacher competency are now being questioned. Criterion referenced testing is now being administered to check for student and teacher competency.

Recent time on task studies have focused much attention on how time is used in the classroom. Teachers, however, are burdened with the collection of lunch money, passing out notices to go home, announcements, and a continuous list of interruptions. Many administrators and Boards of Education are becoming concerned with the wise use of school time.

Time is needed to set up equipment and pass out materials for laboratory science teaching with such programs as SAPA, SCIS, and ESS. When the lesson is over, there must be time set aside for collection of materials and clean up. According to the 1977 National Survey an average of 28 minutes a day is devoted to the subject (see Table I, page 3, which compares time spent in other subjects.)

Table 1

Time Spent In Subjects

	Grade Range					
	K-3		4-6		Total	
Subject	Average Number of Minutes	Standard Error	Average Number of Minutes	Standard Error	Average Number of Minutes	Standard Error
Mathematics	41	.61	51	.43	44	.35
Science	17	.24	28	.64	20	.28
Social St.	21	.62	34	.71	25	.53
Reading	95	1.60	66	1.34	86	1.18
Sample N	467		302		769	

Science Education Databook
(National Science Foundation, 1977)

The Problem

Statement of the problem. This study was concerned with determining the extent of agreement between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory teaching competencies that should be possessed by these elementary teachers. These are the two groups most concerned with this problem.

Importance of the problem. The null hypothesis shall be: There is no significant difference when determining the extent of agreement between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory teaching competencies that should be possessed by elementary science teachers.

The issue of textbooks is also paramount in the elementary science program because there are many to select from. Selecting the correct one in order to obtain the best results can sometimes present problems for the selection committee. If a science textbook is all that is used in a classroom, science may not be especially meaningful for some students. Students need to acquire "hands on" laboratory skills which would be arduous with a textbook. It is also sometimes difficult for a teacher to become competent in teaching science laboratory skills. This is the main reason why some teachers rely on the textbook. When science is taught, a classroom should have an atmosphere of sciencing. Children sitting at their desks with a science textbook in their hands are not doing science, but merely reading about it.

This study also considers the various types of classrooms in which science is taught. The National Science Foundation did a study in 1977 of various types of classrooms that elementary science was being conducted in. Out of a population sample of 271 in grades 4-6, only 9% had a laboratory or special science room, 54% had a classroom with portable science materials, and 34% had a classroom with no science facilities. The data in Table 2 indicates the need for these major improvements (see Table 2 on page 6).

Table 2

Percent of Elementary Science Classes Conducted In Various Types of Rooms, by Grade Range

Type of Room	Grade Range K-3	4-6	Total
Laboratory or special science room	0	9	4
Classroom with portable science materials . .	54	54	54
Classroom with no science facilities	38	34	36
Unknown	8	3	6
Sample N	287	271	558

Science Education Databook
(National Science Foundation, 1977)

Funding is also a problem in elementary science. Inflation has caused many of the programs funded by the National Science Foundation to be discontinued. The elementary science laboratory programs (ESS, SCIS, and SAPA) are being cut. This withdrawl of funds has made it more difficult for teachers to improve their science teaching.

There are thousands of fourth, fifth, and sixth grade teachers in our elementary schools who have a variety of programs from which to select a method of dealing with science. Many of these programs are oriented to a textbook approach; others are directed through laboratory involvement. James and Voltmer were concerned about what competencies teachers should possess in this laboratory approach. Once this is established, the teachers can begin to develop better laboratory teaching skills in the classroom.

Gerlovick, McAnarney, et al, state that there are teachers in our schools who are now teaching elementary science with little or an inadequate background. Could some of these teachers possibly be affecting children's desire to learn? What competencies should teachers acquire? Here-in lies the problem in this dissertation.

Some colleges are now requiring graduating seniors in the field of teaching to take a competency test. Many school systems are also requiring teachers to take a competency test before teaching. With the increase of science technology, the public in general must become more competent with materials in our technological world.

Significance of the Study. The study is significant for elementary science educators, elementary teachers, school boards, and others who come in contact with elementary science education. It is these people who determine the elementary science curriculum which in turn in-

fluences the quality of elementary school science. With criterion referenced testing sweeping the country, there needs to be some accountability of teacher competency. With the advanced technology in the field of science, there is a need to find out what kind of job elementary teachers think should be done and improve upon it. We have to find out if teachers possess laboratory teaching skills. Are they teaching with future generations in mind? This is an important aspect of elementary teaching if our country is to stay ahead of other nations in the field of science. If our country is to continue to be scientifically literate, we must see that our youth are exposed to both past and present discoveries in science concepts.

Teacher educators usually keep abreast with current literature and attend local, state, and national educational meetings. As a rule, they write articles and textbooks for publication; they participate and advocate changes for society. It is these educators who are expected to make rational and meaningful decisions. It is because of this public dependency that the competent teacher can help maintain scientific literacy in our country.

DEFINITION OF TERMS

Science Teacher Educator. For purposes of this study, the author refers to science teacher educators as those who teach elementary science methods classes at the college level to teachers and/or prospective teachers.

Teaching Competencies. The author refers to this as the quality or state of being qualified or adequately prepared in a specific teaching area.

Elementary Teachers. The author refers to this as a teacher who teaches science to fourth, fifth, or sixth grade students.

SCIS. Science Curriculum Improvement Study. A nationally developed elementary science program.

ESS. Elementary Science Study. A nationally developed elementary science program.

SAPA. Science A Process Approach. A nationally developed elementary science program.

Limitations of the Study

1. The study was limited to fourth, fifth, and sixth grade public school elementary teachers of science in Kansas who teach elementary science.
2. The study was limited to college science teacher educators who teach or have taught an elementary science methods course to prospective elementary teachers.
3. The study was limited to the guidelines established in cooperation with the research council of the Wichita Public School System and Kansas State University.
4. The study was limited to a sample population of 450 people.
5. The study was limited to "Teaching Competencies for Teachers of Elementary Science."
6. The study was limited to revised questions and responses taken from the Voltmer-James instrument (1980).

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

This chapter will focus on what others have researched, studied, and written in the area of elementary science. It begins with a 1983 case study by Richard A. Duschl on the elementary level science methods course. Chapter 2 concerns itself with numerous authors who write about the need for and a positive attitude towards elementary science.

Elementary teachers typically teach most subjects. It is primarily science, though, that most troubles the elementary teacher. Unfortunately, the elementary science teaching is of low quality. Part of the reason for this low quality of science may be that back to basics may reduce the time devoted to science. "The apprehension elementary teachers have toward science and the teaching of science may be explained by phenomena associated with training. It is attributable to conflicting pedagogies used in the science courses in which the students enroll. Solutions to the problem of the 'antagonistic dilemma' would seem to be in providing educators with experiences which have an impact on the perceptions they hold toward the nature of science. New strategies for training elementary educators in science need to be considered." Some alternatives identified by Duschl are:

1. to change the science course sequence, placing the methods course before the content courses

2. to have the science content courses taught by science education faculty, individuals who would not only be sympathetic to the

needs of the preservice teachers but would also present science in a manner consistent with the objectives of the elementary science program;

3. to have elementary education majors do independent semester long investigations or replications of previous investigations;

4. to have elementary education majors take history or philosophy of science courses.

Jack Gerlovich; et al (1981, pg. 22-24) wrote, "America is headed toward virtual scientific and technological illiteracy according to a study commissioned in 1980 by the White House." U.S. schools are relaxing their requirements while Japan, Germany, and the Soviet Union require increasingly vigorous science and math training for their citizens. The back-to-the-basics movement has resulted in less time devoted to science in America's schools. Gerlovich further states that, "A survey of elementary (K-6) teachers in Kansas reveals that 45% of these teachers feel qualified to assist colleagues in reading, language arts, or English; 23% feel qualified in mathematics; but only 9% feel qualified in science. The same survey finds that the amount of time these teachers allot to science instruction reflects their subject area confidence. On an average, 342 minutes per week are devoted to reading, 212 minutes to mathematics, 133 minutes to social studies, and 88 minutes to science."

J. Darrell Barnard (1965, pg. 25-26) writes in the Science Teacher that "The schools can and should make a difference in the lives of all children;" the difference, he goes on to say should be positive rather than negative. Teaching science in the schools should help to meet some of the basic needs of all children. Barnard continues by saying, "These needs may include: 1. A need to belong or identify with whatever the child is dealing with, 2. The need to understand, 3. The need to be

independent, able to perform on ones own, 4. The need to be creative."

Kenneth Moore and Jacob Blankenship (1977, pg. 337-345) state that "there are specific unfilled needs which limit the effectiveness of science teachers; therefore, they teach very little science in their classrooms." Their study was threefold in which they: 1. identified the areas in which elementary school teachers need and desire help in order to improve their science teaching, 2. Tested the effect of grade level on the perceived science needs of elementary school teachers. They also defined an elementary school teacher's science need as "a conscious drive, interest, or desire on the part of the elementary teacher that is necessary for the improvement of science teaching." "The conscious drive, interest, or desire results, in part, from the elementary school teacher's interaction with children and it is needed in order to do a better job of teaching."

Further implications of Moore and Blankenship state that "teachers usually teach as they have been taught; thus, elementary school teachers should be exposed to realistic results in experiences in both pre and inservice programs, additional experiences should be incorporated into methodology and content courses; and pre and inservice courses should be taught through realistic science experiences. Once elementary teachers have these experiences, they will be in a position to pass their reactions on to their students." "The development of such programs, then, should address the high priority perceived needs of elementary school teachers and lead to a general upgrading in elementary school science teaching."

INQUIRY - DISCOVERY VS THE TRADITIONAL APPROACH

John H. Wilson completed a study to determine whether or not there was significant difference in the "essential science experience" encouraged by teachers who had received educational direction in the SCIS inquiry-discovery approach and teachers who were educated primarily in the traditional textbook-centered, expository approach to science teaching at the elementary level. Wilson (1967) also hoped to determine whether or not there was a significant difference in the number of questions asked by the traditional science teachers at the elementary school level. His conclusions were as follows:

1. The essential science experience categories of prediction and measurement show significantly higher proportions of experience for the SCIS educated group.

2. For every category of the essential science experiences for inventory, a much larger number of frequencies was recorded in favor of the SCIS educated teachers.

3. The total number of the essential science experiences provided for children by the SCIS educated teachers was 2.15 times as many as the 685 frequencies for the traditional science teachers.

4. The questions considered lower level of recognition and recall were recorded a significantly larger proportion of times for the traditional science teachers group than for the SCIS educated teachers.

5. Higher level questions of analysis and synthesis were recorded a significantly larger proportion of times for the SCIS educated teachers group than for the traditional teachers group.

6. The demonstration of skill type of question was recorded a significantly higher proportion of times in favor of the SCIS educated teachers.

7. The comprehension type of question was recorded a significantly higher proportion of times in favor of the traditional teachers group.

8. The total number of questions asked by teachers educated in SCIS methods and materials was 1.49 times as many questions as the 955 asked by the traditional teachers group.

LABORATORY APPROACH VS TEXTBOOKS

Although textbooks were the main source of information for teaching elementary science in the fifties and sixties, during the sixties and early seventies "new science" lab programs were started. In essence, however, the newness of these programs has faded and textbooks are finding their way back to the classroom. As Dryil (1981, pg. 34-39) points out: "It took a multimillion dollar investment to develop, promote, and market SAPA, SCIS, and ESS. Are we now ready to scrap that investment and go back to square one?" Apparently such is true, for there is a cry for a return to "back to basics" all across the country. Dryil further states, "It has been observed that book-centered students often are more easily controlled than those who are not interested in science, than those who wander about aimlessly in a lab-centered approach." As to the expense in adopting textbooks, the economic aspects are evident only during the introductory year, whereas materials in the labs must be replaced annually.

In continuation, Dryll says "another reason why teachers prefer textbooks to lab centers is because they create a simpler approach. Reading certain chapters and comprehensive testing is easier than gathering a variety of materials; there is also continued coordination, specific teaching competencies, a lot of commitment and effort. Textbook instruction requires that science coordinators offer suggestions, provide encouragement, and lend support to teachers. Unfortunately, with inflation and cutbacks in recent years, a lot of these positions have been eliminated. The National Science Foundation once funded teacher training workshops throughout the country; these funds are no longer available."

James A. Shymansky; et al (1982, pg. 14) "analyzed 34 studies that compared the performance of students in ESS, SCIS, or SAPA classrooms with that of students in traditional, textbook-based classrooms. The average student in the ESS, SCIS or SAPA classroom performed better than 62% of the students in traditional classrooms across all performance criteria measured--a 12 percentile-point again." Their quantitative synthesis of the research clearly showed that students in those programs achieved more, liked science more, and improved their skills more than did students in traditional, textbook-based classrooms. "It seems only fair and in the best interest of students to give these programs another critical look."

ESS FOR GEOGRAPHICALLY ISOLATED ELEMENTARY TEACHERS

In William Miller Jr.'s (1975) study, teachers in rural areas of low population density in an inservice course of instruction were studied in order to evaluate the effectiveness in: 1. Teaching a new

elementary science curriculum's philosophical approach and methodology; 2. Developing an attitude toward science and the teaching of science more consistent with the philosophy and goals of the new science curricula; and 3. Developing a positive attitude toward the program of inservice instruction itself. The materials that Millar used were taken from the Elementary Science Study (ESS) curriculum project.

The results of the study were as follows: 1. The cognitive objectives of knowledge of the ESS curriculum project were found to have been met in excess of the criterion level on the Chi Square one sample test; 2. The attitude toward the science teaching goal was met at the criterion level according to the Wilcoxen signed - ranks test; 3. No significant changes were produced in subject attitude toward science.

TEACHERS FACING TECHNOLOGY

David McCrory (1915) asks the question, "What is and how do we attain a critical mass that will alter or change present inadequate teaching learning processes in the technologies?" McCrory suggests that if real change is to be made in the teaching-learning process, the classroom teacher who is responsible for program operation at the local level must receive help. McCrory says the emphasis, therefore, has to be on the individual teacher and his/her meeting the challenge of change. This process requires continual individual training and possibilities of improvement from the colleges, universities, or public agencies.

COMPETENCY DEVELOPMENT IN PRESERVICE PREPARATION

Doris K. West states that "among other problems associated with

teaching is the knowledge explosion in science with which future teachers have to be prepared to cope. There is more material in each science field than one person could be expected to learn in a lifetime."

Paul Hurd and James Gallagher (1968, pg. 2) posed three interesting questions pertaining to the vast amount of information that is available at the elementary school level: "How Can an elementary school curriculum be designed that is up to date when the amount of scientific knowledge doubles in the time it takes a child to progress from kindergarten to high school? What kind of instruction is needed for today's children who before middle age will have access to eight times as much knowledge as there is currently? Is it possible to invent a science curriculum for use in the elementary school that will enable one to live comfortably and meaningfully with and to appreciate its changing system of concepts, theories, and methods?"

John I. Goodlad (1969) discussed current problems in the educational process as it affected the prospective elementary school teacher as follows: The separate-subject approach creates few immediately apparent problems for the secondary school. Traditionally, high school teachers have been prepared in a major field and supporting disciplines. Teaching in that major field in the high school permits a smooth transition from their own studies. Fusing two or more subjects, on the other hand, adds a curriculum planning burden to teaching demands and often calls for collaborative effort with colleagues. The separate-subject approach, however, creates some immediately apparent problems for the elementary school. First, elementary school teachers in most states are prepared as generalists rather than as specialists in subject fields. Second, there is a limit to the number of disciplines that can be taught

within the time available, and some difficult choices must therefore be made. It is difficult to find room in the curriculum for thirty or more separate subjects. Third, if the basic structures and concepts of the academic disciplines form the curriculum design of secondary education, what is to be the approach for elementary education? Is there something of a more basic nature than what has been conceived for the high school?

Richard E. Haney (1966, pg. 33) pointed out that the majority of elementary school teachers were still expected to teach all facets of the total school program in self-contained classrooms. Few teachers were adequately prepared for these manifold tasks in their undergraduate college programs; therefore, the problem was magnified: "The elementary school teacher who attempts to teach science is in the most precarious position of all. The attempts made by several of the projects to write materials that could be well taught regardless of the qualifications of the teacher have been partly successful. The elementary science programs include some highly sophisticated concepts such as systems, interaction, and the making of operational definitions. One can only wonder what these can mean to the teacher with anything less than a natural science major in his college background. It is doubtful that the most elaborate teacher's guide could substitute for a teacher who is well grounded in the subject matter of science and in recent developments in child psychology."

There has been a number of studies concerned with the attitude of teachers toward elementary science. Among those reporting their research findings are Stollberg (1969), Hone and Carswell (1969), Washton (1971), and Shrigley (1972, 1973). Many seem to be in agreement that elementary teachers, as a group, have less than a positive attitude toward the teaching of science.

The need for additional research on science attitudes is summarized by Ramsey and Howe (1969, pg. 62-68): "A student's attitudes toward science may well be more important than his understanding of science since his attitudes determine how he will use knowledge. For this reason, the development of attitude as part of science instruction is in an area requiring increasing research." "If it can be assumed that the student's attitude toward science is affected by the attitude of the teacher (and Washton's (1971) study supports this assumption) than a positive attitude of elementary teachers toward science is imperative."

Eysenck et al. (1972) support Cohen (1972) with the following statement: "...the extent to which a communication is effective in changing attitudes depends upon the perceived credibility of the source..."

The results of Cohen's study indicate that the more credible professional qualities of a science educator were that he:

1. refer to practical teaching activities he had experience with the elementary school classroom
2. has taught science for several years in the elementary school classroom
3. model in the college classroom modes of teaching similar to those he expects his students to use when they teach young children
4. assume some responsibility for teaching science content
5. assume some responsibility for assisting college science professors in developing appropriate science content courses for elementary education majors
6. assume some responsibility for counseling students during student teaching
7. be involved in assisting inservice teachers in the develop-

ment of science curricula

In addition, Cohen indicated that the science education should:

1. teach a few lessons to elementary age students each term
2. counsel former students in their beginning years of teaching
3. be involved in research having to do with elementary science methods
4. write elementary science textbooks
5. write the book for science methods course

The results of this study indicate that the following qualities thought to be components of instructor credibility were marginal and therefore were considered invalid until further research has been conducted:

1. that the science educator has had experience teaching subjects other than science to children
2. that the science educator assume some responsibility for dealing with topics that are not specifically science methods (e.g. classroom discipline)

Houston and Howsam (1972) identified the following characterisitics of competency based instruction in educational psychology, science methods and other professional areas for preservice teachers:

1. specification of learner objectives in behavioral terms
2. specification of the means for determining whether performance meets the indicated criterion level
3. provisions for one or more modes of instruction pertinent to the objectives
4. public sharing of the objectives, criteria, means of assessment, and alternative activities

5. assessment of the learning experience in terms of the competency criteria

6. placement on the learner of the accountability for meeting the criteria

Capie and Markle (1974) suggest that "instruction in academic courses does not generally reflect competency-based influence, perhaps because specific terminal objectives have not been explicitly stated. Science courses for preservice elementary teachers are an exception." Capie and Markle go on to say that "it is interesting to note that a physics course at the University of Georgia is based on a competency-based model for developing knowledge, skills, and attitudes prerequisite to successful elementary science teaching." They further state "elementary science should play an important role in helping the student in learning the nature of scientific inquiry and the key operations or process of science. A program based on inquiry and process will encourage real learning not the memorization of facts. Elementary science programs should encourage the student to think critically; it should encourage development in scientific attitudes and skills. Science courses for preservice elementary teachers must be directed toward these goals if elementary science instruction is to reflect this approach."

TEACHER CHARACTERISTICS

Bohn (1968) says "much of the research on teacher effectiveness has been based on the assumption that teaching competence can be measured by overall effectiveness of student learning. Also, it is frequently assumed that the teacher who stimulates the greatest student growth in one basic skill will stimulate the greatest growth in other

skills."

Mitzell (1960) states, however, "...that though the evidence is fragmentary it predominantly supports a multidivisional view of teaching effectiveness." Barr (1945) suggest that "research data indicates certain teacher qualities and actions as prerequisite to certain outcomes and other qualities to be prerequisite to yet other outcomes." He feels there is as much need for differential prediction in teacher personnel research as there is in pupil personnel research. (In 1935) Barr stated that "the ultimate criterion for teaching success will have to be found in the changes produced in pupils as measured against the objectives of education." In 1954, Erikson stated that "teaching effectiveness as determined by pupil learning could be considered an index of success or as an index of effectiveness for that teacher."

Mitzel (1960, pg. 1481-1486) suggests that: "... product criteria of teaching success should consist primarily of measures of the goal oriented effects of teachers on children obtained immediately after the periods in which children attend the schools." On the other hand, Hellfritch's (1945) study revealed no single measure that could be substituted for the actual measurement of pupil growth in evaluating the ability of the teacher to teach.

IMPLEMENTATION APPROACH

Dr. Guy Wall (1975) did a study with the following conclusions: 1. Teachers in a four and one-half week summer workshop designed to implement investigative-inquiry science teaching displayed significantly greater science process orientation than teachers in a graduate elementary science methods course, and control teachers. 2. The presence of

a linear trend in teachers' SPI scores justifies the conclusion that increased implementation investigative-inquiry science teaching results in increased science process orientation. 3. Upper elementary grade students taught by summer workshop teachers were not able to use science inquiry skills significantly better than similar students of control teachers. 4. The relationship between the science process orientation of summer workshop participants and their students' ability to use science inquiry skills was inconclusive. 5. The relationship between the science process orientation of inservice leaders and their participants was also inconclusive.

WHAT DIRECTION(S) ELEMENTARY SCHOOL SCIENCE?

Harry McAnarney (1978) points out that the future of elementary school science will be influenced significantly by how teachers view the contributions of science to the total school program. McAnarney states that it is unfortunate that some teachers are not entirely positive about science for promoting the broad, overall goals of education. McAnarney goes on to say that science does not compete well with the conventional three R's and might realistically be thought of as an elective in the sense that science becomes a part of the activities in a given class if and to the extent that the teacher wishes to include it. He stresses that the teacher should not, for personal or other reasons, become an impediment to effective instruction in science or any other subject. McAnarney further states that one could stress that it is not easy to form a positive attitude toward science or any other subject if the person involved has feelings of inadequacy about or is uncomfortable with the subject. He therefore says that some or perhaps many teachers

who outwardly maintain that science is not as essential may use science as a scapegoat to disguise or hide a lack of desire to teach or incompetency in science.

Chiraphongse (1975) did a study of the characteristics of elementary science teachers in Thailand and the competencies needed for improving their teaching. The data he obtained revealed that the failure rate of elementary students from the primary grade through the seventh grade was a significant financial and human waste. In some cases, the failure rate was nearly 50 percent. An analysis of the obtained data indicated that student absenteeism, lack of educational materials and facilities, mobility and uncertainty as to parents' occupation, and a serious shortage of competent teachers were the factors causing student failure.

In summary, most of the studies pointed out a need for increased teacher competency in elementary science. Several even wrote about a need for a positive change in attitude of both elementary teachers and students toward elementary science. The lack of inservice training, workshops, time, and money were also found to be key factors in improving instruction in the field of elementary science.

CHAPTER 3

METHODS

Sample

This dissertation focuses upon a study of the laboratory science teaching skills of elementary teachers. The study was conducted in the academic year 1982-1983. The total group sample was comprised of 363 participants, 107 science educators and 256 elementary teachers.

A questionnaire was sent to one hundred fifty elementary science educators across the country (see questionnaire in Appendix C). The science educators were required to have had experience in teaching elementary science in a college methods classroom in order to qualify as participants in the survey. Their names were taken from a list provided by the Association for the Educators of Teachers of Science and the School Science and Mathematics Association. The list was the same as that used by Rita Voltmer (1980) in her study of "Laboratory Teaching Competencies for Science Teachers." Voltmer identified some elementary college educators, which she did not use in her study. Dr. Robert James and Dr. Harry McAnarney helped the author identify others. Only names identified by the above people were used in this study.

The same questionnaire was sent to three hundred elementary teachers in the state of Kansas. The sample population was stratified. School districts were randomly selected according to the following elementary school enrollment:

20,000 - plus

2,500 - 19,999

1,000 - 2,499

500 - 999

Under - 500

Schools were then randomly selected from the school districts. Three hundred teachers were randomly selected selected according to the following stratification chart:

Table 3

Population of Randomly Selected Teachers

Estimated Elementary School Enrollment Population	4th	5th	6th	Total # of Teachers by Population
20,000 plus	20	20	20	60
2,500-19,999	20	20	20	60
1,000-2,499	20	20	20	60
500-999	20	20	20	60
Under 500	20	20	20	60
Total	100	100	100	300

Total # of randomly selected teachers

INSTRUMENT

The questionnaire consists of seven parts: Protection of Human Subjects Statement, Demographic Information, Operational Competencies, Process Competencies, Management Competencies, Developmental Competencies, and Evaluation Competencies. The questionnaire was adapted from an instrument by Voltmer and James (1980). The Voltmer-James instrument was developed for college students preparing to be secondary science teachers and secondary science teacher educators. The instrument used in this study was modified from the Voltmer-James study to elementary teachers and elementary science teacher educators at the college level. "The Laboratory Safety Competencies" was omitted from this instrument and some questions were left out or changed to relate to elementary teachers. The Likert Scale was also changed to five parts instead of nine.

The instrument was tested for validity and reliability at the .05 alpha level. It was field tested with the teachers at Clark Elementary School in Wichita, Kansas. The instrument was also sent to 12 science educators across the state to see if the instrument measured what it was intended to measure. These educators suggested some changes in the instrument; the changes were made before the instrument was field tested at Clark Elementary.

A Likert Scale was used for teachers and professors to indicate the extent to which they thought elementary teachers should have developed each science laboratory competency by placing a checkmark in one part on each of the Likert Scales. The scores were numbered from one to five, with one as the highest degree of attainment and five as the lowest.

DATA ANALYSIS

Procedure

A chi square (X^2) statistic was used in analyzing the data using a 2x5 matrix. Table 4 shows the 2x5 matrix with the Likert Scale. The response of each educator and teacher was recorded in the cells according to how they responded on the questionnaire.

Table 4

Likert Scale

	1	2	3	4	5
Teachers					
Science Educators					

A cross tabulation was also done on the operational, process, management, developmental, and evaluation competencies. There are 21 operational competencies, 6 process competencies, 4 management competencies, 4 developmental competencies, and 7 evaluation competencies. Each question was tested for a significant difference between elementary teachers and college educators at the .05 alpha level using 4 degrees of freedom.

The researcher allowed two weeks after the questionnaire was sent before a follow-up was made to obtain the return of the remaining questionnaires. The follow-up was in the form of letters and/or telephone calls. There was a combined 80% return of the questionnaires.

The information on the questionnaire was key punched on IBM computer cards. Once this was done, the researcher used the Statistical Package for the Social Sciences (SPSS) to have the computer print out the program.

The information in Chapter 4 shall consist of the analyzation of the data collected and acceptance or rejection of the null hypothesis. The fifth and final chapter shall then consist of findings, conclusions and implications, recommendations, recommendations for future research, and summary.

CHAPTER 4

PRESENTATION AND ANALYSIS OF DATA

Introduction

The purpose of this study was to determine the extent of agreement between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory teaching competencies that should be possessed by these elementary teachers.

Teachers were selected from school districts that were randomly selected according to student population of the district. College educators were selected from a list from the Association for the Educators of Teachers of Science and the School Science and Mathematics Association. A total of 363 respondents, 256 teachers, and 107 professors was used.

A frequency distribution was done on six criterion variables of demographic information in the questionnaire. This distribution included the highest degree earned, age, number of science magazines read regularly, number of years teaching, weekly time allotment of elementary science methods course, and whether or not the participants were pleased with the materials they were using.

DATA ANALYSIS

Operational Competencies

The null hypothesis of 21 operational competencies was that there was no significant difference in the extent of agreement with operational

competencies between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory operational teaching competencies that should be possessed by these elementary teachers.

Tables 5-13 shows a cross-tabulation on a 2x5 matrix on nine of the operational competencies that showed a significant difference. Row 1 represents the teacher group and Row 2 represents the science educator group. The five columns represent the breakdown of the Likert Scale.

Table 5

Use of the Microscope

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	90 35.2	78 30.5	69 27.0	16 6.3	3 1.2	256
Sci Ed	38 35.5	26 24.3	26 24.3	10 9.3	7 6.5	107
Column Total	128	104	94	26	10	363

Raw chi square = 10.11765 with 4 degrees of freedom
Level of significance = 0.0385

Table 6

Culturing and Maintaining Populations in the Classroom including Daphnia, Elodea, Guppies, Mealworms, Butterflies, Etc.

05 Count / Row Pct.	1	2	3	4	5	Row Total
Teachers	30 11.8	63 24.8	77 30.3	59 23.2	25 9.8	254
Sci Ed	27 25.5	38 35.8	27 25.5	8 7.5	6 5.7	106
Column Total	57	101	104	67	31	360

Raw chi square - 24.07506 with 4 degrees of freedom
Level of significance = 0.0001

Table 7

Cleaning Glassware

09 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	38 15.3	49 19.7	91 36.5	44 17.7	27 10.8	249
Sci Ed	8 7.5	26 24.5	32 30.2	19 17.9	21 19.8	106
Column Total	46	75	123	63	48	355

Raw chi square = 9.53421 with 4 degrees of freedom
Level of significance = 0.0490

Table 8

Use of Keys for Identification of Rocks, Etc.

010

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	54 21.1	98 38.3	89 34.8	13 5.1	2 0.8	256
Sci Ed	35 32.7	36 33.6	25 23.4	6 5.6	5 4.7	363
Column Total	89	134	114	19	7	363

Raw chi square = 13.68279 with 4 degrees of freedom
Level of significance = 0.0084

Table 9

Preparation, Maintenance and Use of Terraria and Aquaria

013

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	40 15.8	82 32.4	95 37.5	20 7.9	16 6.3	253
Sci Ed	54 50.5	31 29.0	16 15.0	5 4.7	1 0.9	107
Column Total	94	113	111	25	17	360

Raw chi square = 53.08299 with 4 degrees of freedom
Level of significance = 0.0001

Table 10

Use of the Metric System

016

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	112 43.8	67 26.2	48 18.8	15 5.9	14 5.5	256
Sci Ed	69 64.5	24 22.4	9 8.4	1 0.9	4 3.7	107
Column Total	181	91	57	16	18	363

Raw chi square = 16.67331 with 4 degrees of freedom
Level of significance = 0.0022

Table 11

Models (e.g. of the Solar System, Parts of Organisms, Etc.)

017

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	99 38.8	96 37.6	50 19.3	10 3.9	0 0.0	255
Sci Ed	26 25.2	34 33.0	34 33.0	6 5.8	3 2.9	103
Column Total	125	130	84	16	3	358

Raw chi square = 17.94800 with 4 degrees of freedom
Level significance = 0.0013

Table 12

Use of Histograms

019

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	30 12.9	67 28.8	79 33.9	38 16.3	19 8.2	233
Sci Ed	38 36.2	32 30.5	21 20.0	10 9.5	4 3.8	105
Column Total	68	99	100	48	23	338

Raw chi square = 28.71564 with 4 degrees of freedom
Level of significance = 0.0001

Table 13

Electrical Circuits and Batteries

020

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	59 21.1	100 39.2	69 27.1	18 7.1	9 3.5	255
Sci Ed	38 36.5	44 42.3	20 19.2	2 1.9	0 0.0	104
Column Total	97	144	89	20	9	359

Raw chi square = 14.08015 with 4 degrees of freedom
Level of significance = 0.0070

The preceding tables (5-13) all show significant differences at the .05 alpha level. Table 5 was significant at the .038 level with the significance occurring at the top end of the Likert Scale. Table 6 was significant at the .0001 level with the significance also at the top end of the scale. Table 7 shows significance at the .0490 level with the difference at the bottom end of the scale. Table 8 shows a significant difference at the .0084 level with the difference in the middle of the scale. Tables (9-13) all show significant differences at the .0001, .0022, .0013, .0001, and .0070 respectively at the top end of the Likert Scale.

DATA ANALYSIS

Process Competencies

The null hypothesis of the six process competencies in Tables 14-19 stated that there was a significant difference in the extent of agreement with process competencies between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory process competencies that should be possessed by these elementary teachers.

Table 14

Questioning Technique

PI Count Row Pct	1	2	3	4	5	Row Total
Teachers	147 57.4	79 30.9	24 9.4	5 2.0	1 0.4	256
Sci Ed	97 91.5	6 5.7	2 1.9	1 0.9	0 0.0	106
Column Total	244	85	26	6	1	362

Raw chi-square = 39.92184 with 4 degrees of freedom
Level of significance = 0.0001

Table 15

Formulating Hypotheses

Count / Row Pct	P2 1	2	3	4	5	Row Total
Teachers	115 44.9	95 37.1	32 12.5	12 4.7	2 0.8	256
Sci Ed	79 73.8	21 19.6	5 4.7	2 1.9	0 0.0	107
Column Total	194	116	37	14	2	363

Raw chi square = 25.94426 with 4 degrees of freedom
Level of significance = 0.0001

Table 16

Defining and Delineating a Scientific Problem

Count / Row Pct	P3 1	2	3	4	5	Row Total
Teachers	97 38.0	95 37.3	52 20.4	7 2.7	4 1.6	255
Sci Ed	77 72.0	23 21.5	4 3.7	2 1.9	1 0.9	107
Column Total	174	118	56	9	5	362

Raw chi square = 37.75392 with 4 degrees of freedom
Level of significance = 0.0001

Table 17

Planning Experiments by Identifying and Controlling the Variables

P4 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	102 39.8	92 35.9	45 17.6	15 5.9	2 0.8	256
Sci Ed	81 75.7	19 17.8	2 1.9	4 3.7	1 0.9	107
Column Total	183	111	47	19	3	363

Raw chi square = 42.45406 with 4 degrees of freedom
Level of significance = 0.0001

Table 18

Collect Data by Observing, Identifying Sources of Error, and Interpreting Data

P5 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	99 38.8	82 32.2	56 22.0	13 5.1	5 2.0	255
Sci Ed	88 82.2	15 14.0	2 1.9	2 1.9	0 0.0	107
Column Total	187	97	58	15	5	362

Raw chi square = 59.74620 with 4 degrees of freedom
Level of significance = 0.0001

Table 19

Organization of Data Tables for Interpretation

P6 Count Row Pct	1	2	3	4	5	Row Total
Teachers	86 33.6	80 31.3	63 24.6	19 7.4	8 3.1	256
Sci Ed	75 70.1	25 23.4	5 4.7	2 1.9	0 0.0	107
Column Total	161	105	68	21	8	363

Raw chi square = 47.66447 with 4 degrees of freedom
Level of significance = 0.0001

The above Tables 14-19 all show significant differences at the .05 alpha level with the differences all being at the .0001 level. The differences all occurred in cell 1 of the Likert Scale.

DATA ANALYSIS

Management Competencies

The null hypothesis of the four management competencies in Tables 20-23 is that there is no significant difference in the extent of agreement with management competencies between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory management competencies that should be possessed by these elementary teachers. None of the management competencies showed any significant differences however.

Table 20

Organization and Execution of Field Trips

M1 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	139 54.3	75 29.3	32 12.5	6 2.3	4 1.6	256
Sci Ed	47 43.9	43 40.2	14 13.1	3 2.8	0 0.0	107
Column Total	186	118	46	9	4	363

Raw chi square = 6.09373 with 4 degree of freedom
Level of significance = 0.1923

Table 21

Managing the Classroom

M2 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	189 74.1	48 18.8	14 5.5	3 1.2	1 0.4	255
Sci Ed	81 76.4	21 19.8	2 1.9	0 0.0	2 1.9	106
Column Total	270	69	16	3	3	361

Raw chi square = 5.54447 with 4 degrees of freedom
Level of significance = 0.2358

Table 22

Use of Teacher Aides, Student Teachers, Student Assistants in the Classroom

M3

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	93 36.5	81 31.8	59 23.1	14 5.5	8 3.1	255
Sci Ed	37 34.6	33 30.8	30 28.0	6 5.6	1 0.9	107
Column Total	130	114	89	20	9	362

Raw chi square = 2.30437 with 4 degrees of freedom
Level of significance = 0.6800

Table 23

Locating and Using Resource People, Materials in the Community

M4

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	137 53.5	87 34.0	26 10.2	5 2.0	1 0.4	256
Sci Ed	52 48.6	35 32.7	15 14.0	5 4.7	0 0.0	107
Column Total	189	122	41	10	1	363

Raw chi square = 3.82781 with 4 degrees of freedom
Level of significance = 0.4298

None of the management competencies showed a significant difference at the .05 alpha level. The null hypothesis was retained in this area for Tables 20-23.

DATA ANALYSIS

Developmental Competencies

The null hypothesis of the four developmental competencies in Tables 24-26 is that there is no significant difference in the extent of agreement with developmental competencies between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory developmental competencies that should be possessed by these elementary teachers.

Table 24

Planning and Conducting Demonstrations
With a Hands on Approach

D2 Count Row Pct	1	2	3	4	5	Row Total
Teachers	135 52.9	92 36.1	24 9.4	2 0.8	2 0.8	255
Sci Ed	71 68.9	26 25.2	3 2.9	1 1.0	2 1.9	103
Column Total	206	118	27	3	4	358

Raw chi square = 10.89272 with 4 degrees of freedom
Level of significance = 0.0278

Table 25

Designing the Materials and Conducting Individualized Learning

D3 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	46 18.1	112 44.1	76 29.9	13 5.1	7 2.8	254
Sci Ed	41 38.3	46 43.0	17 15.9	2 1.9	1 0.9	107
Column Total	87	158	93	15	8	361

Raw chi square = 21.57191 with 4 degrees of freedom
Level of significance = 0.0002

Table 26

Construction, Procurement and Improvement of Low-Budget and Homemade Equipment

D4 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	70 27.5	108 42.4	53 20.8	14 5.5	10 3.9	255
Sci Ed	57 53.3	35 32.7	10 9.3	4 3.7	1 0.9	107
Column Total	127	143	63	18	11	362

Raw chi square = 24.44199 with 4 degrees of freedom
Level of significance = 0.0001

Tables 24-26 all shows a significant difference at the .05 alpha level with the differences being .0278, .0002, and .0001 respectively. The differences all occurred at the top end of the scale.

DATA ANALYSIS

Evaluation Competencies

The null hypothesis of the seven evaluation competencies in Tables 27-29 is that there is no significant difference in the extent of agreement with evaluation competencies between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory evaluation competencies that should be possessed by these elementary teachers.

Table 27

Evaluation of Student Progress in the Laboratory Using Skills, Tests, and Observational Checklists

Count / Row Pct	E1 1	2	3	4	5	Row Total
Teachers	92 36.2	95 37.4	54 21.3	8 3.1	5 2.0	254
Sci Ed	54 50.5	36 33.6	10 9.3	4 3.7	3 2.8	107
Column Total	146	131	64	12	8	361

Raw chi square = 10.41439 with 4 degrees of freedom
Level of significance = 0.0340

Table 28

Use of Student Feedback Instruments

E2

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	72 28.6	96 38.1	65 25.8	12 4.8	7 2.8	252
Sci Ed	48 44.9	33 30.8	23 21.5	1 0.9	2 1.8	107
Column Total	120	129	88	13	9	359

Raw chi square = 10.91324 with 4 degrees of freedom
Level of significance = 0.0276

Table 29

Audio Tape Technique

E4

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	23 9.1	69 27.3	99 39.1	38 15.0	24 9.5	253
Sci Ed	19 17.9	31 29.2	44 41.5	9 8.5	3 2.8	106
Column Total	42	100	143	47	27	359

Raw chi square = 12.02588 with 4 degrees of freedom
Level of significance = 0.0172

Tables 27-29 all shows a significant difference at the .05 alpha level with the differences being at .0340, .0275, and .0172 respectively. The differences all occurred at the top end of the scale.

Tables 30-46 does not show a significant difference between science educators and teachers at the .05 alpha level.

Table 3C

Use of the Microprojector

02 Count Row Pct	1	2	3	4	5	Row Total
Teachers	26 10.7	45 18.4	61 25.0	57 23.4	55 22.5	244
Sci Ed	15 14.0	22 20.6	32 29.9	21 19.6	17 15.9	107
Column Total	41	67	93	78	72	351

Raw chi square = 3.64270 with 4 degrees of freedom
Level of significance = 0.4565

Table 31

Preparation of Cultures in Petri Dishes

03 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	26 10.3	46 18.3	90 35.7	48 19.0	42 16.7	252
Sci Ed	5 4.8	17 16.3	38 36.5	26 25.0	18 17.3	104
Column Total	31	63	128	74	60	356

Raw chi square = 4.00458 with 4 degrees of freedom
Level of significance = 0.4054

Table 32

Microscope Techniques for the Preparation and Use of Slides for Microscope Viewing

04 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	51 20.4	82 32.8	71 28.4	29 11.6	17 6.8	250
Sci Ed	14 13.2	28 26.4	39 36.8	12 11.3	13 12.3	106
Column Total	65	110	110	41	30	356

Raw chi square = 7.43036 with 4 degrees of freedom
Level of significance = 0.1148

Table 33

Use of a Polaroid, Instamatic, or 35mm Camera

06 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	30 11.7	60 23.4	80 31.3	43 16.8	43 16.8	256
Sci Ed	18 16.8	31 29.0	30 28.0	20 18.7	8 7.5	107
Column Total	48	91	110	63	51	363

Raw chi square = 7.48715 with 4 degrees of freedom
Level of significance = 0.1123

Table 34

Film Developing

07 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	7 2.7	18 7.1	51 20.0	71 27.8	108 42.4	255
Sci Ed	3 2.8	3 2.8	21 19.6	29 27.1	51 47.7	107
Column Total	10	21	72	100	159	362

Raw chi square = 2.85761 with 4 degrees of freedom
Level of significance = 0.5819

Table 35

Production of Slides and Prints

08 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	11 4.4	21 8.4	56 22.3	73 29.1	90 35.9	251
Sci Ed	4 3.8	7 6.7	23 21.9	28 26.7	43 41.0	105
Column Total	15	28	79	101	133	356

Raw chi square = 1.00215 with 4 degrees of freedom
Level of significance = 0.9095

Table 36

Collecting Plants and Animals including Microorganisms for Use in the Classroom and Display

011 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	61 24.0	96 37.8	68 26.8	17 6.7	12 4.7	254
Sci Ed	34 31.8	38 35.5	26 24.3	7 6.5	2 1.9	107
Column Total	95	134	94	24	14	361

Raw chi square = 3.59022 with 4 degrees of freedom
Level of significance = 0.4643

Table 37

Preserving Plants and Animals for
Display and Use in the Classroom

012 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	45 17.6	78 30.6	84 32.9	27 10.6	21 8.2	255
Sci Ed	18 16.8	31 29.0	31 29.0	19 17.8	8 7.5	107
Column Total	63	109	115	46	29	362

Raw chi square = 3.57107 with 4 degrees of freedom
Level of significance = 0.4672

Table 38

Introduction to and the Uses of the Planetarium

014 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	43 16.9	80 31.5	89 35.0	29 11.4	13 5.1	254
Sci Ed	10 9.3	30 28.0	37 34.6	21 19.6	9 8.4	107
Column Total	53	110	126	50	22	361

Raw chi square = 8.25152 with 4 degrees of freedom
Level of significance = 0.0828

Table 39

General Maintenance of Laboratory Equipment

015 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	75 29.3	92 35.9	72 28.1	11 4.3	6 2.3	256
Sci Ed	32 30.2	37 34.9	25 23.6	11 10.4	1 0.9	106
Column Total	107	129	97	22	7	362

Raw chi square = 5.93975 with 4 degrees of freedom
Level of significance = 0.2037

Table 40

Group Discussions

018 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	157 61.6	60 23.5	33 12.9	4 1.6	1 0.4	255
Sci Ed	77 73.3	20 19.0	5 4.8	3 2.9	0 0.0	105
Column Total	234	80	38	7	1	360

Raw chi square = 8.01664 with 4 degrees of freedom
Level of significance = 0.0910

Table 41

Preparing Solutions of Known Concentration

Q21

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	33 13.0	69 27.2	96 37.8	34 13.4	22 8.7	254
Sci Ed	11 10.4	31 29.2	37 34.9	18 17.0	9 8.5	106
Column Total	44	100	133	52	31	360

Raw chi square = 1.37568 with 4 degrees of freedom
Level of significance = 0.8484

Table 42

Writing Objectives in Measurable Terms for Elementary Science Lessons

D1

Count / Row Pct	1	2	3	4	5	Row Total
Teachers	70 27.3	90 35.2	67 26.2	18 7.0	11 4.3	256
Sci Ed	49 39.3	33 30.8	23 21.5	4 3.7	5 4.7	107
Column Total	112	123	90	22	16	363

Raw chi square = 5.92299 with 4 degrees of freedom
Level of significance = 0.2050

Table 43

Video Tape Technique

E3 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	27 10.6	75 29.5	79 31.1	48 18.9	25 9.8	254
Sci Ed	12 11.3	36 34.0	37 34.9	17 16.0	4 3.8	106
Column Total	39	111	116	65	29	360

Raw chi square = 4.60404 with 4 degrees of freedom
Level of significance = 0.3304

Table 44

Parental Feedback

E5 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	41 16.2	85 33.6	97 38.3	21 8.3	9 3.6	253
Sci Ed	31 29.0	36 33.6	32 29.9	6 5.6	2 1.9	107
Column Total	72	121	129	27	11	360

Raw chi square = 9.04889 with 4 degrees of freedom
Level of significance = 0.0599

Table 45

Faculty, Staff, and Others - Feedback

E6 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	50 19.8	86 34.1	93 36.9	12 4.8	11 4.4	252
Sci Ed	22 20.8	44 41.5	37 34.9	1 0.9	2 1.9	106
Column Total	72	130	130	13	13	358

Raw chi square = 5.49101 with 4 degrees of freedom
Level of significance = 0.2405

Table 46

Administrative Evaluation
(Principal)

E7 Count / Row Pct	1	2	3	4	5	Row Total
Teachers	37 14.7	87 34.5	92 36.5	23 9.1	13 5.2	252
Sci Ed	11 10.8	37 36.3	43 42.2	4 3.9	7 6.9	102
Column Total	48	124	135	27	20	354

Raw chi square = 4.43761 with 4 degrees of freedom
Level of significance = 0.3500

It is interesting to note that the Process Competency area showed the highest level of significance at the .0001 alpha level. The significance shows in the first two levels of the Likert Scale. Elementary science educators rated each question higher in the first two levels than did elementary science teachers. The management competency area showed no significant difference at the .05 alpha level of significance.

CHAPTER 5

FINDINGS, CONCLUSIONS AND IMPLICATIONS, RECOMMENDATIONS, AND SUMMARY

FINDINGS

The findings of this study were based upon the questionnaire "Survey of Laboratory Teaching Competencies for Teachers of Elementary Science," filled out by selected elementary science educators and selected fourth, fifth, and sixth grade science teachers. The questions were based on a Likert Scale of one through five where one was high and five was low.

Operational Competencies

All questions were cited for significant differences at the .05 level. Under the area of Operational Competencies, the null hypothesis was rejected. The first question, Use of the Microscope, was found significant at the .0385 level; 65.7% of the elementary teachers rated this question 1 or 2 on the Likert Scale compared to 59.8% of the science educators.

Question 5, Culturing and Maintaining Populations in the Classroom including Daphnia, Elodea, Guppies, Mealworms, Butterflies, etc., was significant at the .0001 level; 36.5% of the elementary teachers rated this question 1 or 2 compared to 61.3% of the science educators.

Question 9, Cleaning Glassware, was significant at the .0490 level; 28.5% of the elementary teachers rated this 4 or 5 while 37.7% of the science educators rated it 4 or 5.

Question 10, Use of Keys for Identification of Rocks, Etc., was significant at the .0084 level; 57% of the science educators rated this question 2 or 3 compared to 73.1% of the elementary teachers.

Question 13, Preparation, Maintenance and Use of Terraria and Aquaria, was significant at the .0001 level; 50% of the science educators rated this number 1 compared to 15% of the elementary teachers.

Question 16, Use of the Metric System, was significant at the .0022 level; 86% of the science educators rated this number 1 or 2 compared to 70% of the elementary teachers.

Question 17, Models (e.g. of the Solar System, Parts of Organisms, etc.), was significant at the .0013 level; 58.2% of the science educators rated this 1 or 2 compared to 76.4% of the elementary teachers.

Question 19, Use of Histograms, was significant at the .0001 level; 66.7% of the science educators rated this 1 or 2 compared to 41.7% of the elementary teachers.

Question 20, Electrical Circuits and Batteries, was significant at the .0070 level; 78.8% of the science educators rated this 1 or 2 compared to 62.3% of the elementary teachers.

Process Competencies

There was a significant difference between elementary teachers and science educators in all 6 of the questions in the process competencies area. The null hypothesis was rejected. Each one was significant at the .0001 level. The science educators rated each of the 6 questions very high.

Question 1, Questioning Technique, was rated 91.5% by science educators compared to 57.4% of the elementary teachers group in number 1 on the Likert Scale.

Question 2, Formulating Hypothesis was rated 73.8% by science educators compared to 44.9% of the elementary group in cell 1.

Question 3, Defining and Delineating a Scientific Problem, was rated 72% by science educators compared to 38% of the elementary teacher group in cell 1.

Questions 4, Planning Experiments by Identifying and Controlling the Variables, was rated 75.7% by science educators compared to 39.8% of the elementary teacher group in cell 1.

Questions 5, Collect Data by Observing, Identifying Sources of Error, and Interpreting Data, was rated 82.2% by science educators compared to 38.8% of the elementary teacher group in cell 1.

Question 6, Organization of Data Tables for Interpretation, was rated 70.1% by science educators compared to 33.6% of the elementary teacher group in cell 1.

Management Competencies

There was no significant difference between elementary teachers and science educators in any of the four questions in the Management Competency area. The null hypothesis was retained.

Developmental Competencies

There was a significant difference between elementary teachers and science educators, and the null hypothesis was rejected in 3 out of

4 of the questions in the Developmental Competency area.

Question 2, Planning and Conducting Demonstrations with a Hands on Approach, was significant at the .0278 level. Science educators rated this question 94.1% in cells 1 and 2 of the Likert Scale, while elementary teachers rated it 89% in cells 1 and 2.

Question 3, Designing the Materials and Conducting Individualized Learning, was significant at the .0002 level. The science educators rated this 81.3% in cells 1 and 2 while elementary teachers rated it 62.2% in cells 1 and 2.

Question 4, Construction, Procurement and Improvement of Low-Budget and Homemade Equipment, was significant at the .0001 level. The science educators rated this 86% in cells 1 and 2 while elementary teachers rated it 69.9% in cells 1 and 2.

Evaluation Competencies

There was a significant difference between elementary teachers and science educators, and the null hypothesis was rejected in 3 out of 7 of the questions in the Evaluation Competency area.

Question 1, Evaluation of Student Progress in the Laboratory Using Skills Tests, and Observational Checklists, was significant at the .0340 level. The science educators rated this 84.1% in cells 1 and 2 while elementary teachers rated it 73.6% in cells 1 and 2.

Question 2, Use of Student Feedback Instruments, was significant at the .0276 level. The science educators rated this 75.7% in cells 1 and 2 while the elementary teachers rated it 66.7% in cells 1 and 2.

Question 4, Audio Tape Technique, was significant at the .0172

level. The science educators rated this 47.1% in cells 1 and 2 while elementary teachers rated it 36.4% in cells 1 and 2.

CONCLUSIONS AND IMPLICATIONS

The conclusions obtained from this study were based upon the hypotheses which were central throughout the study. Under the area of Operational Competencies, the null hypothesis was rejected in questions 1, 5, 9, 10, 13, 16, 17, 19 and 20. There was a significant difference between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers at the .05 level.

Question 1, Use of the Microscope, showed the elementary teachers who participated in the study thought that the microscope is an important science laboratory teaching competency that elementary teachers need. They rated this concept higher than science educators.

In Question 5, Culturing and Maintaining Populations in the Classroom including Daphnia, Elodea, Guppies, Mealworms, Butterflies, etc., the science educators rated this higher than elementary teachers, but both thought this was an important competency.

Question 9, Cleaning Glassware, shows that there was also a significant difference between science educators and elementary teachers but it was at the lower end of the scale with the science educators rating it the lowest.

Question 10, Use of Keys for Identification of Rocks, Etc., shows that both elementary teachers and science educators rated this mostly in the middle of the scale with science educators rating it slightly higher.

In Question 13, Preparation, Maintenance and Use of Terraria and Aquaria, science educators rated this area much higher than elementary teachers.

Question 16, Use of the Metric System shows that science educators again rated this area higher than elementary teachers.

Question 17, Models (e.g. of the Solar System, Parts of Organisms, etc.), shows that elementary teachers rated this area higher than did science educators.

In Question 19, Use of Histograms, science educators rated this area higher than did elementary teachers.

In Question 20, Electrical Circuits and Batteries, science educators rated this area higher than did elementary teachers. There were no significant differences between science educators and elementary teachers in any of the other questions in the operational competencies area.

Under the area of process competencies, the null hypothesis was rejected. There was a significant difference in all six questions with science educators thinking that elementary teachers should have developed these competencies much more than elementary teachers thought they should. All six of the following questions were rated high in cell one by science educators: 1. Questioning technique; 2. Formulating hypothesis; 3. Defining and delineating a scientific problem; 4. Planning experiments by identifying and controlling the variable; 5. Collect data by observing, identifying sources of error, and interpreting data, and 6. Organization of data tables for interpretation.

The null hypothesis was retained in the area of Management Competencies which produced no significant differences between science

educators and elementary teachers.

The null hypothesis was rejected under the area of Developmental Competencies, there was a significant difference in Question 2, Planning and Conducting Demonstrations with a Hands on Approach, science educators rated this area higher than did elementary teachers.

In Question 4, Construction, Procurement and Improvement of Low-Budget and Homemade Equipment, science educators rated this question higher than elementary teachers.

The null hypothesis was rejected under the area of Evaluation Competencies; there was a significant difference in Question 1, Evaluation of Student Progress in the Laboratory Using Skills Texts, and Observational Checklists, science educators rated this question higher as they did Question 2, Use of Student Feedback Instruments and Question 4, Audio Tape Techniques.

From an extensive review of the related literature, there was no known study that explored the direct relationship of elementary teacher competencies between elementary teachers of science and elementary science educators. This study provides evidence that there is a significant difference between the two groups. The differences occurred in the area of operational competencies in questions 1, 5, 9, 10, 13, 16, 17, 19 and 20. In the area of process competencies, the differences occurred in all six questions. The differences occurred in questions 2 and 4 in the developmental competencies, and in questions 1, 2, and 4 of the evaluation competencies.

The differences where the competencies were not significant were in questions 2, 3, 4, 6, 7, 8, 11, 12, 14, 15, 18 and 21 of the operational competencies. Under the management competency area there was no

significant difference in any of the questions. Under the developmental competencies there were no significant differences in questions 1 and 3. In the evaluation competencies there was no significant difference in questions 3, 5, 6, and 7. The implication is that the management competency area is not needed, while the process competency area is definitely needed. In the other competency areas only those questions that produced significant differences need to be studied.

RECOMMENDATIONS

The recommendations offered as a result of this study may serve as a focal point for those who seek to resolve the problems related to elementary science laboratory teaching competencies. The recommendations are primarily directed at science educators of elementary science, elementary teachers, administrators of elementary schools, and school boards. These people make changes in the field of elementary science laboratory teaching competencies. Further study is needed in the field.

The following recommendations are offered, based on the findings of this study:

1. The same questionnaire should be administered to the primary grade teachers (Kindergarten through grade three) to determine if the results are the same as those in the intermediate grades (fourth through sixth).
2. Teachers should keep abreast of current trends and changes in elementary science.
3. Competency skills in elementary science should be acquired by elementary teachers through inservice training, workshops, and college courses.

4. School boards should provide necessary funding for inservice training and workshops in their system, with competent instructors to conduct the workshops.
5. Administrators should make certain that their schools have the necessary equipment for teachers. They should also make sure that teachers have the necessary training, either through inservice training or workshops. It is their responsibility to make sure that teachers in the schools are competent to teach elementary science.
6. Science educators should make sure the following are taught and emphasized in their classroom: A. Operational Competencies; 1. Use of the microscope, and 2. Models (e.g. of the solar system, parts of organisms, etc.) 3. Culturing and maintaining populations in the classroom including daphnia, elodea, guppies, mealworms, butterflies, etc., 4. Preparation, maintenance, and use of terraria and aquaria, 5. Use of the metric system, 6. Use of histograms, 7. Electrical circuits and batteries. B. Process Competencies; 1. Questioning technique, 2. Formulating hypotheses, 3. Defining and delineating a scientific problem, 4. Planning experiments by identifying sources of error, and interpreting data, and 6. Organization of data tables for interpretation. C. Developmental Competencies; 1. Planning and conducting demonstrations with a hands on approach, 2. Designing the materials and conducting individualized learning, and 3. Construction, procurement and improvement of low-budget and

homemade equipment. D. Evaluation Competencies; 1. Evaluation of student progress in the laboratory using skills tests, and observational checklists, 2. Use of student feedback instruments, and 3. Audio tape technique.

Recommendations for Future Research

1. The same questionnaire should be administered in different states throughout the United States to see if the results are the same.
2. The same questionnaire should be administered in the same population area in ten years to see if there are changes in attitude about laboratory teaching competency skills.
3. Other statistical tests should be used to see if the results are the same e.g. t-test, and/or analysis of variance.
4. Administer the questionnaire to elementary teachers of science, have them take a workshop, inservice training, or science course that include the recommended competencies of this study, and then administer the same questionnaire again.

SUMMARY

The purpose of this study was to determine the extent of agreement between selected elementary science educators and selected fourth, fifth, and sixth grade science teachers in Kansas in regard to the science laboratory teaching competencies that should be possessed by these elementary teachers.

The study was conducted in the academic year 1982-1983. The total group sample was comprised of 363 participants--107 science educators

and 256 elementary teachers. Each group was given the questionnaire entitled "Survey of Laboratory Teaching Competencies for Teachers of Elementary Science." The categorical classifications were: 1. Operational Competencies; 2. Process Competencies; 3. Management Competencies; 4. Developmental Competencies; and 5. Evaluation Competencies. The only difference in the questionnaire of the two groups was the demographic information at the beginning.

The Statistical Package for the Social Sciences (SPSS) was the source of the statistical program for the analysis of data. A chi square (x^2) test was used to test for significant distributions between the groups.

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APPENDIX A

DEMOGRAPHIC ANALYSIS

College Educators

The demographic information showed that all of the science educators had at least a masters degree, while none of the teachers had a doctorate. It also pointed out that none of the science educators was under the age of 26 and only one was between the age of 26-30 while many of the teachers were between 21-35. Most of the teachers do not read science magazines regularly while a considerable number of the science educators read at least one. The average number of years teaching experience by both groups is closely related. A great number of the educators were pleased with the materials they were using while the majority of the teachers had mixed feelings or were displeased with the materials.

In Variable I there was no college educator out of 107 who had a BA or BS degree; ten had MA or MS degrees; none of them had a specialist degree; 34 had an Ed.D. degree, and 63 had a Ph.D. degree.

Table 47

Degrees of College Educators

VARIABLE I

Highest Earned	Degree (Code)	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative ADJ Frequency (Percent)
MA/MS	(2)	10	9.3	9.3	9.3
Ed.D	(4)	34	31.8	31.8	41.1
Ph.D.	(5)	63	58.9	58.9	100.0
Total		107	100.0	100.0	

Mean	4.402	Standard Err	0.087	Median	4.651
Mode	5.000	Standard Dev	0.899	Variance	0.809
Range	3.000				

In Variable 2, it is interesting to point out here that none of the college educators was under the age of 26, and only 1 was between the age of 26 and 30. The average age group of college educators in the study is between 46 and 50.

Table 48

Age of College Educators

Variable 2 Age	(Code)	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
26-30	2	1	0.9	1.0	1.0
31-35	3	7	6.5	6.7	7.7
36-40	4	9	8.4	8.7	16.3
41-45	5	27	25.2	26.0	42.3
46-50	6	22	20.6	21.2	63.5
51-55	7	12	11.2	11.5	75.0
56-60	8	9	8.4	8.7	83.7
61-65	9	12	11.2	-1.5	95.2
66 +	10	5	4.7	4.8	100.0
Out of Range		3	2.8	Missing	100.00
Total		107	100.0	100.0	

Mean	6.154	Standard Err	0.187	Median	5.864
Mode	5.000	Standard Dev	1.909	Variance	3.646
Range	8.000				

Variable 3 indicates that most college educators read at least one science magazine on a regular basis.

Table 49

Number of Science Magazines Read by College Educators

Variable 3

# of Mag.	(Code)	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
None	1	9	8.4	8.4	8.4
1 to 2	2	35	32.7	32.7	41.1
3 to 4	3	20	18.7	18.7	59.8
4 or more	4	43	40.2	40.2	100.00
Total		107	100.0	100.0	

Mean	2.907	Standard Err	0.100	Median	2.975
Mode	4.000	Standard Dev	1.033	Variance	1.067
Range	3.000				

Variable 4 shows that the mean number of years teaching for college educators is 11.7.

Table 50

Number of Years Teaching of College Educators

Variable 4

Years	(Code)	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
0		6	5.6	5.7	5.7
1		1	0.9	0.9	6.6
2		1	0.9	0.9	7.5
3		5	4.7	4.7	12.3
4		8	7.5	7.5	19.8
5		4	3.7	3.8	23.6
6		4	3.7	3.8	27.4
7		4	3.7	3.8	31.1
8		7	6.5	6.6	37.7
9		2	1.9	1.9	39.6
10		6	5.6	5.7	45.3
11		8	7.5	7.5	52.8
12		7	6.5	6.6	59.4
13		6	5.6	5.7	65.1
14		3	2.8	2.8	67.9
15		4	3.7	3.8	71.7
16		4	3.7	3.8	75.5
17		8	7.5	7.5	83.0
18		2	1.9	1.9	84.9
19		1	0.9	0.9	85.8
20		4	3.7	3.8	89.6
21		1	0.9	0.9	90.6
22		1	0.9	0.9	91.5
25		2	1.9	1.9	93.4
28		2	1.9	1.9	95.3
30		4	3.7	3.8	99.1
35		1	0.9	0.9	100.0
		1	0.9	Missing	100.0
Total		107	100.0	100.0	100.0

Mean	11.764	Standard Err	0.743	Median	11.125
Mode	4.000	Standard Dev	7.653	Variance	58.563
Range	35.000				

The average number of minutes for an elementary science class being taught by college educators is 215.1 per week.

Table 51

Number of Minutes per week for an Elementary Science Class Being Taught by College Educators

Variable 5 # of Minutes	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
0	8	7.5	8.2	8.2
90	1	0.9	1.0	9.2
100	1	0.9	1.0	10.2
120	8	7.5	8.2	18.4
150	6	5.6	6.1	24.5
180	38	35.5	38.8	63.3
200	1	0.9	1.0	64.3
240	11	10.3	11.2	75.5
250	2	1.9	2.0	77.6
270	1	0.9	1.0	78.6
300	9	8.4	9.2	87.8
360	5	4.7	5.1	92.9
480	4	3.7	4.1	96.9
720	3	2.8	3.1	100.0
	9	8.4	Missing	100.0
Total	107	100.0	100.0	100.0

Mean	215.102	Standard Err	13.631	Median	180.158
Mode	180.000	Standard Dev	135.138	Variance	18262.348
Range	720.000				

Variable 6 indicates that 69.2 percent of the college educators were pleased with the materials they were using.

Table 52

Extent to Which College Educators are Pleased or Displeased with Materials

Variable 6 Response (Code)		Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
Yes	1	74	69.2	77.9	77.9
No	2	13	12.1	13.7	91.6
Mixed	3	8	7.5	8.4	100.0
		12	11.2	Missing	100.0
Total		107	100.0	100.0	

Mean	1.305	Standard Err	0.064	Median	1.142
Mode	1.000	Standard Dev	0.620	Variance	0.385
Range	2.000				

DEMOGRAPHIC ANALYSIS

Elementary Teachers

Variable I indicates that 157 teachers out of 256 have a BA or BS degree, 94 have an MS degree, 5 have a Specialist degree, and no elementary teacher has a doctorate.

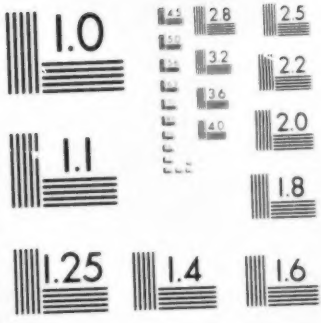
Table 53

Degrees of Elementary Teachers

Variable I Highest Earned	Degree (Code)	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
BA/BS	1	157	61.3	61.3	61.3
MA/MS	2	94	36.7	37.7	98.0
Ed.S	3	5	2.0	2.0	100.0
Total		256	100.0	100.0	

Mean	1.406	Standard Err	0.033	Median	1.315
Mode	1.000	Standard Dev	0.530	Variance	0.281
Range	2.000				

PG



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

The average age of teachers indicated by Variable 2 is 36-40 years old.

Table 54

Age of Teachers

Variable 2 Age	(Code)	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
21-25	1	19	7.4	7.5	7.5
26-30	2	42	16.4	16.6	24.1
31-35	3	47	18.4	18.6	42.7
36-40	4	41	16.0	16.2	58.9
41-45	5	30	11.7	11.9	70.8
46-50	6	24	9.4	8.5	80.2
51-55	7	18	7.0	7.1	87.4
56-60	8	18	7.0	7.1	94.5
61-65	9	13	5.1	5.1	99.6
66 +	10	1	0.4	0.4	100.0
		3	1.2	Missing	100.0
Total		256	100.0	100.0	

Mean	4.344	Standard Err	0.142	Median	3.951
Mode	3.000	Standard Dev	2.265	Variance	5.131
Range	9.000				

Many teachers do not read science magazines regularly as indicated by Variable 3, and those whc do, read only 1 or 2.

Table 55

Number of Science Magazines Read by Teachers

Variable 3 # of Mag.	(Code)	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
None	1	189	73.8	73.8	73.8
1 to 2	2	57	22.3	22.3	96.1
3 to 4	3	6	2.3	2.3	98.4
4 or more	4	4	1.6	1.6	100.0
Total		256	100.0	100.0	

Mean	1.316	Standard Err	0.037	Median	1.177
Mode	1.000	Standard Dev	0.599	Variance	0.358
Range	3.000				

The average number of years taught by the teacher group is 11.238 years indicated in variable 4.

Table 56

Number of Years Teaching Experience

Variable 4 Years	(Code)	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
0		3	1.2	1.2	1.2
1		10	3.9	3.9	5.1
2		16	6.3	6.3	11.3
3		15	5.9	5.9	17.2
4		14	5.5	5.5	22.7
5		28	7.0	7.0	29.7
6		13	5.1	5.1	34.8
7		15	5.9	5.9	40.6
8		12	4.7	4.7	45.3
9		11	4.3	4.3	49.6
10		11	4.3	4.3	53.9
11		8	3.1	3.1	57.0
12		17	6.6	6.6	63.7
13		10	3.9	3.9	67.6
14		10	3.9	3.9	71.5
15		14	5.5	5.5	77.0
16		7	2.7	2.7	79.7
17		8	3.1	3.1	82.8
18		2	0.8	0.8	83.6
19		2	0.8	0.8	84.4
20		6	2.3	2.3	86.7
21		1	0.4	0.4	87.1
22		2	0.8	0.8	87.9
23		4	1.6	1.6	89.5
24		2	0.8	0.8	90.2
25		3	1.2	1.2	91.4
26		2	0.8	0.8	92.2
27		1	0.4	0.4	92.6
28		4	1.6	1.6	94.1
29		3	1.2	1.2	95.3
30		7	2.7	2.7	98.0
31		2	0.8	0.8	98.8
32		1	0.4	0.4	99.2
38		1	0.4	0.4	99.6
42		1	0.4	0.4	100.0
Total		256	100.0	100.0	

Mean	11.238	Standard Err	0.516	Median	9.591
Mode	5.000	Standard Dev	8.248	Variance	68.033
Range	42.000				

Variable 5 indicates that the average number of minutes elementary science is taught by the teacher group is 143.3 per week.

Table 57

Number of Minutes Elementary Science Is Taught Per Week by Elementary Teachers

Variable 5 # Of Minutes	Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
20	1	0.4	0.4	0.4
25	2	0.8	0.8	1.2
30	3	1.2	1.2	2.4
35	1	0.4	0.4	2.8
40	3	1.2	1.2	4.0
45	4	1.6	1.6	5.6
50	1	0.4	0.4	6.0
60	16	6.3	6.4	12.4
70	1	0.4	0.4	12.8
75	4	1.6	1.6	14.4
85	1	0.4	0.4	14.8
90	20	7.8	8.0	22.8
100	13	5.1	5.2	28.0
120	43	16.8	17.2	45.2
125	2	0.8	0.8	46.0
135	2	0.8	0.8	46.8
140	2	0.8	0.8	47.6
150	66	25.8	26.4	74.0
155	1	0.4	0.4	74.4
175	3	1.2	1.2	75.6
180	16	6.3	6.4	82.0
200	10	3.9	4.0	86.0
210	4	1.6	1.6	87.6
225	13	5.1	5.2	92.8
240	2	0.8	0.8	93.6
250	3	1.2	1.2	94.8
270	2	0.8	0.8	95.6
300	10	3.9	4.0	99.0
825	1	0.4	0.4	100.0
Out of Range	6	2.3	Missing	100.0
Total	256	100.0	100.0	

Mean	143.360	Standard Err	4.702	Median	149.591
Mode	150.000	Standard Dev	74.344	Variance	5527.012
Range	805.000				

Variable 6 indicates that 115 teachers are pleased with the materials they are using, but 94 were not, and 43 had mixed feelings.

Table 58

Pleased or Displeased With Materials of Teachers

Variable 6 Response (Code)		Absolute Frequency	Relative Frequency (Percent)	Adjusted Frequency (Percent)	Cumulative Frequency (Percent)
Yes	1	115	44.9	45.6	45.6
No	2	94	36.7	37.3	82.9
Mixed	3	43	16.8	17.1	100.0
Out of Range		4	1.6	Missing	100.0
Total		256	100.0	100.0	

Mean	1.714	Standard Err	0.047	Median	1.617
Mode	1.000	Standard Dev	0.740	Variance	0.548
Range	2.000				

The demographic information also contained the following question: "If you had a free hand to make changes in teaching elementary science education, briefly describe what they would be." The author chose statements from each group. Statements were synthesized to include all of the views presented by the participants.

College Educators

"All science would be hands-on discovery (inquiry) oriented activity taught by individuals who were philosophically aligned with such procedures."

"The changes I would make would come in courses prior to science methods. There would be (1) a course on the meaning of science, (2) a course using the processess of science, (3) an in-depth course on Piaget."

"More time devoted to elementary science methods and science content."

"A balance between process and product (reading about science) either (A) require more science courses of elementary teachers or (B) change the requirements and have science specialist 2-6 as per music and are specialists."

"Availability of a far greater quantity of materials for science methods students to use to teach lessons in schools."

"More field work prior to student teaching. Students going out into public schools to teach their science lessons to elementary pupils."

"(1) I would require all students to take an introductory Chemistry, Physics, Biology and Geology course prior to the methods course. These science courses would be the regular courses for science majors, not courses for the elementary majors. (2) I would teach the elementary science methods course in an elementary school where I had access to elementary students to demonstrate teaching techniques and then to use to let the college students practice teaching science lesson."

"Upgrade the content courses. More content; less meaningless process. Train individuals to think not just become technicians."

"Require it in all states for certification; increase secondary graduation requirements; at elementary level, make it as basic as 3R'S."

"A strong integration of science content with methodology. integration of computer literacy with course content. More information dealing with multi-cultural education in relation to science education."

"In-service workshops for teachers and administrators (also parents) on ESS. More time for preservice methods course (presently teacning a 3-unit course for science and math methods combined."

"As a verb - Science is what scientists do - children should be learning science skills/processes - observing, describing, collecting, and recording data on charts, tables of data, graphs, illustrations, etc. identifying and controlling variables, experimenting, generalizing from data, etc."

Teachers

"More materials for experimenting."

"Textbook and materials suited toward my grade level. I believe we need content reading and hands on. The content in the present text is too abstract. This age student still needs more hands on."

"More hands on experience for children."

"More experiments which relate to concepts being taught. It would also be beneficial to take related field trips."

"Make it more basic so they can understand it better--I don't feel molecules are appropriate to 4th graders."

"I do have--Science curriculum chairman. Have in-service; have workshops; consult with teachers for ideas; did have a newsletter; did and will consult with faculties and teachers to give ideas if asked; on textbook committees, etc."

"Better awareness of what's happening grade to grade; an activity everday (with time to plan it!); 'slightly' extended budget to update equipment."

"I would have a textbook that goes along with our kits. The kits seem to be interesting to the students. It would help if we had more microscopes available."

"Individualized experimental approach."

"I would strongly suggest that (1) Teachers be given more training in the teaching of science for many teachers don't feel comfortable in that area; (2) If more training is available, make it a requirement for certification in the future; (3) Make textbooks available to complement the 'hands-on' materials that are available to use in USD #259."

APPENDIX B

Department of Curriculum and Instruction

College of Education
Bluemont Hall
Manhattan, Kansas 66506
913-532-5550

November 5, 1982

Dear Principal:

The Department of Curriculum and Instruction at Kansas State University and the Research Council of the Wichita Public Schools have given their approval for a study entitled "Survey of Laboratory Teaching Competencies for Teachers of Elementary Science." Your school has been randomly selected to participate in this study.

Please distribute the enclosed survey form(s) to the teacher(s) whose name appears on the cover letter. The form(s) should be collected by November 12, 1982 and returned in this envelope via interschool mail to Henry C. Donaldson, Clark Elementary School.

If you have any questions, please call me at 682-6406 or Mr. John Bobula, Coordinator of Science Education, Wichita Public Schools, telephone number 268-7765, who has been designated as the contact person for this research.

Your cooperation in this research project will be greatly appreciated.

Sincerely,

Henry C. Donaldson
Doctoral Candidate

Approved: _____
Harry McAnarney, Ed.D.
Advisor

_____
John Bobula
Coordinator of
Science Education USD #259

Department of Curriculum and Instruction

College of Education
Bluemont Hall
Manhattan, Kansas 66506
913-532-5550

November 5, 1982

Dear Principal:

I am writing this letter to ask for your help in completing a doctoral research study entitled "Survey of Laboratory Teaching Competencies for Teachers of Elementary Science."

Your school has been randomly selected to participate in this research project that has been endorsed by the Department of Curriculum and Instruction at Kansas State University.

This study is concerned with determining the extent of agreement between nationally selected elementary science educators and selected fourth, fifth, and sixth grade teachers of elementary science in Kansas in regard to the laboratory teaching competencies that should be possessed by these elementary teachers of science. The study will provide much needed information about teachers' perceptions in regard to the teaching of elementary school science.

Teachers will be asked to complete a questionnaire, "Survey of Laboratory Teaching Competencies for Teachers of Elementary Science," by placing checkmarks on a Likert scale.

Please complete and return the enclosed postcard. Be assured that teacher anonymity will be guaranteed with the research findings.

If you have any questions regarding the research, please contact Henry C. Donaldson, 7677 E. 21st, Apt. 1809, Wichita, Kansas 67206, telephone number (316) 685-3675 or Dr. Harry McAnarney, College of Education, Bluemont Hall, Manhattan, Kansas 66506, telephone number (913) 532-5530. Your cooperation will be very much appreciated.

Sincerely,

Henry C. Donaldson

Henry C. Donaldson
Doctoral Candidate

Approved: Harry McAnarney

Harry McAnarney, Ed.D.
Advisor

Department of Curriculum and Instruction

College of Education
Bluemont Hall
Manhattan, Kansas 66506
913-532-5550

November 5, 1982

Dear Science Educator:

I am writing this letter to ask for your help in completing a doctoral research study entitled "Survey of Laboratory Teaching Competencies for Teachers of Elementary Science." The enclosed instrument is being sent to three hundred elementary teachers of science in Kansas and one hundred fifty college professors of elementary science education nationwide requesting their help in collecting data relative to the teaching of elementary science.

This study is concerned with determining the extent of agreement between selected elementary science educators nationwide and selected fourth, fifth, and sixth grade elementary teachers of science in Kansas in regard to the laboratory teaching competencies that should be possessed by these elementary teachers.

All research being conducted in this study will fall under the guidelines established by Kansas State University and your name has been randomly selected. Here are some important considerations you should be cognizant of: (1) all information asked of you is completely confidential and your name will never be associated with your responses in any way; (2) you do not need to place your name on any of the materials; and (3) all information requested is for research purposes only.

Please complete the enclosed instrument, "Survey of Laboratory Teaching Competencies for Teachers of Elementary Science." It is vital to the research that this information be returned immediately. If you have any questions, please write or call Henry C. Donaldson, 7677 E. 21st, Apt. 1809. Wichita, Kansas 67206, telephone number (316) 685-3675 or Dr. Harry McAnarney, College of Education, Bluemont Hall, Manhattan, Kansas 66506, telephone number (913) 532-5530. We appreciate your cooperation.

Sincerely,

Henry C. Donaldson

Henry C. Donaldson
Doctoral Candidate

Approved: Harry McAnarney
Harry McAnarney, Ed.D.
Advisor

Department of Curriculum and Instruction

College of Education
Bluemont Hall
Manhattan, Kansas 66506
913-532-5550

November 19, 1982

Dear Teacher:

I am writing this letter to ask for your help in completing a doctoral research study entitled "Survey of Laboratory Teaching Competencies for Teachers of Elementary Science." The enclosed instrument is being sent to three hundred elementary teachers of science in Kansas and one hundred fifty college professors of elementary science education nationwide requesting their help in collecting data relative to the teaching of elementary science.

This study is concerned with determining the extent of agreement between selected elementary science educators nationwide and selected fourth, fifth, and sixth grade elementary teachers of science in Kansas in regard to the laboratory teaching competencies that should be possessed by these elementary teachers.

All research being conducted in this study will fall under the guidelines established by Kansas State University and your name has been randomly selected. Here are some important considerations you should be cognizant of: (1) all information asked of you is completely confidential and your name will never be associated with your responses in any way; (2) you do not need to place your name on any of the materials; and (3) all information requested is for research purposes only.

Please complete the enclosed instrument, "Survey of Laboratory Teaching Competencies for Teachers of Elementary Science," and return it to your building principal. It is vital to the research that this information be returned immediately. If you have any questions, please write or call Henry C. Donaldson, 7677 E. 21st, Apt. 1809, Wichita, Kansas 67206, telephone number (316) 685-3675 or Dr. Harry McAnarney, College of Education, Bluemont Hall, Manhattan, Kansas 66506, telephone number (913) 532-5530. We appreciate your cooperation.

Sincerely,

Henry C. Donaldson

Henry C. Donaldson
Doctoral Candidate

Approved: Harry McAnarney
Harry McAnarney, Ed.D.
Advisor

APPENDIX C

SURVEY OF LABORATORY TEACHING COMPETENCIES FOR TEACHERS OF

ELEMENTARY SCIENCE

PROTECTION OF HUMAN SUBJECTS STATEMENT

This survey is being conducted under guidelines established by Kansas State University. By cooperating, you will help provide answers to important questions; however, your participation is strictly voluntary. It is recognized that by completing the survey, you have voluntarily given your consent to participate in this study. You should omit any questions which you feel unduly invade your privacy or which are otherwise offensive to you. Please be advised that you have the right to withdraw from participation in this study at any time or not to participate in the study at all. Confidentiality is guaranteed; your name will not be associated with your answers in any public or private report of the results. Inquiries about the study prior to and/or after your participation are welcome.

DEMOGRAPHIC INFORMATION

Please answer all of the following items as indicated:

1. Highest degree earned _____

2. Number of years teaching elementary science education _____

3. Current position _____

4. Weekly time allotment for elementary science methods course _____

5. Are you pleased with the materials you are now using? _____

6. What science magazines do you read regularly? _____

7. Age group: ___21-25, ___26-30, ___31-35, ___36-40, ___41-45, ___46.50, ___51-55, ___56-60, ___61-65, ___66+.

8. If you had a free hand to make changes in teaching elementary science education, briefly describe what they would be:

(over)

General Directions:

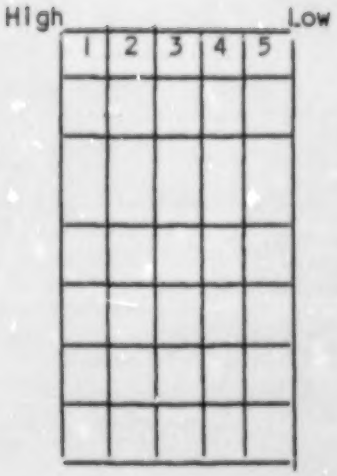
Below and on the following pages are listed science laboratory competencies which might be deemed appropriate for all upper elementary teachers of science. This list represents an attempt to specify laboratory teaching competencies which all elementary teachers of science might need. We have omitted significant areas of competence related to the teaching of specific disciplines. Please respond to each competency according to the directions given below.

Please estimate the extent to which you think elementary teachers of science should have developed each competency by placing a check mark in one space on each of the Likert Scales.

OPERATIONAL COMPETENCIES

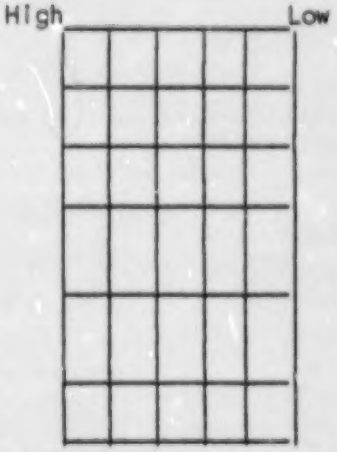
	High				Low
	1	2	3	4	5
1. Use of the Microscope					
2. Use of the Microprojector					
3. Preparation of cultures in "Petri dishes"					
4. Microscope techniques for the preparation and use of slides for microscope viewing					
5. Culturing and maintaining populations in the classroom including daphnia, elodea, guppies, mealworms, butterflies, etc.					
6. Use of a polaroid, instamatic, or 35mm camera					
7. Film Developing					
8. Production of slides and prints					
9. Cleaning glassware					
10. Use of keys for identification of rocks, etc.					
11. Collecting plants and animals, including micro-organisms for use in the classroom and display					
12. Preserving plants and animals for display and use in the classroom					
13. Preparation, maintenance and use of terraria and aquaria					
14. Introduction to and the uses of the planetarium					
15. General maintenance of laboratory equipment					

Operational Competencies (continued)



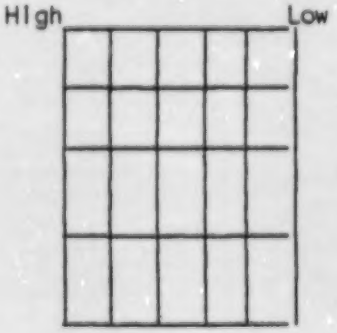
16. Use of the metric system
17. Models (e.g. of the solar system, parts of organisms, etc.)
18. Group discussions
19. Use of histograms
20. Electrical circuits and batteries
21. Preparing solutions of known concentration

PROCESS COMPETENCIES



1. Questioning technique
2. Formulating hypotheses
3. Defining and delineating a scientific problem
4. Planning experiments by identifying and controlling the variables
5. Collect data by observing, identifying sources of error, and interpreting data
6. Organization of data tables for interpretation

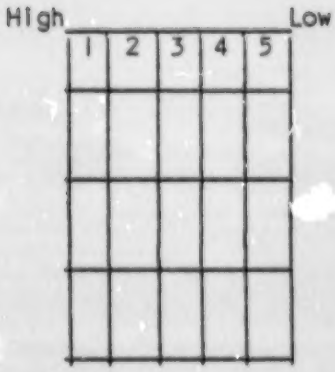
MANAGEMENT COMPETENCIES



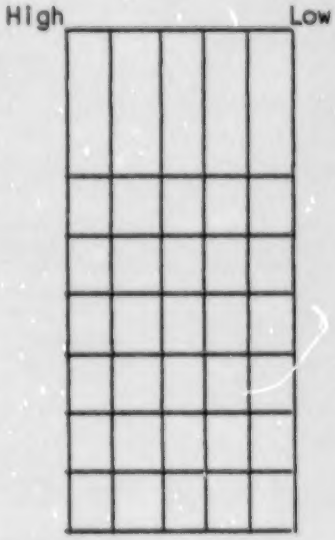
1. Organization and execution of field trips
2. Managing the classroom
3. Use of teacher aides, student teachers, student assistants in the classroom
4. Locating and using resource people, materials in the community

DEVELOPMENTAL COMPETENCIES

1. Writing objectives in measurable terms for elementary science lessons

Developmental Competencies (continued)

2. Planning and conducting demonstrations with a hands on approach
3. Designing the materials and conducting individualized learning
4. Construction, procurement and improvement of low-budget and homemade equipment

EVALUATION COMPETENCIES



1. Evaluation of student progress in the laboratory using skills tests and observational checklists
2. Use of student feedback instruments
3. Video Tape technique
4. Audio Tape technique
5. Parental feedback
6. Faculty, staff and others-feedback
7. Adminstrative evaluation

SURVEY OF LABORATORY TEACHING COMPETENCIES FOR TEACHERS OF

ELEMENTARY SCIENCE

PROTECTION OF HUMAN SUBJECTS STATEMENT

This survey is being conducted under guidelines established by Kansas State University. By cooperating, you will help provide answers to important questions; however, your participation is strictly voluntary. It is recognized that by completing the survey, you have voluntarily given your consent to participate in this study. You should omit any questions which you feel unduly invade your privacy or which are otherwise offensive to you. Please be advised that you have the right to withdraw from participation in this study at any time or not to participate in the study at all. Confidentiality is guaranteed; your name will not be associated with your answers in any public or private report of the results. Inquiries about the study prior to and/or after your participation are welcome.

DEMOGRAPHIC INFORMATION

Please answer all of the following items as indicated:

1. Grade assignment _____
2. School district number _____
3. Highest degree earned _____
4. Number of years teaching elementary science education. _____
5. Current occupational position _____
6. Weekly time allotment for elementary science? _____
7. Are you pleased with the materials you are now using? _____
8. What science magazines do you read regularly? _____
9. Age group: ___21-25, ___26-30, ___31-35, ___36-40, ___41-45, ___46-50, ___51-55, ___56-60, ___61-65, ___66+
10. If you have a free hand to make changes in teaching elementary science education, briefly describe what they would be:

(over)

General Directions:

Below and on the following pages are listed science laboratory competencies which might be deemed appropriate for all upper elementary teachers of science. This list represents an attempt to specify laboratory teaching competencies which all elementary teachers of science might need. We have omitted significant areas of competence related to the teaching of specific disciplines. Please respond to each competency according to the directions given below.

Please estimate the extent to which you think elementary teachers of science should have developed each competency by placing a check mark in one space on each of the Likert Scales.

OPERATIONAL COMPETENCIES

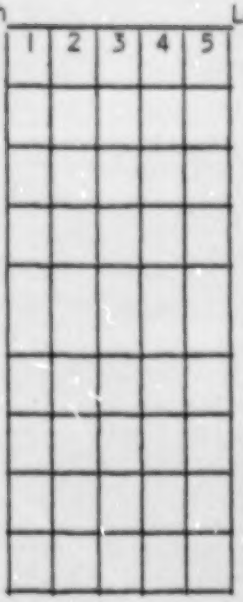
High _____ Low

	1	2	3	4	5
1. Use of the Microscope					
2. Use of the Microprojector					
3. Preparation of cultures in "Petri dishes"					
4. Microscope techniques for the preparation and use of slides for microscope viewing					
5. Culturing and maintaining populations in the classroom including daphnia, elodea, guppies, mealworms, butterflies, etc.					
6. Use of a polaroid, instamatic, or 35mm camera					
7. Film developing					
8. Production of slides and prints					
9. Cleaning Glassware					
10. Use of Keys for identification of rocks, etc.					
11. Collecting plants and animals, including micro-organisms for use in the classroom and display					
12. Preserving plants and animals for display and use in the classroom					
13. Preparation, maintenance and use of terraria and aquaria					

Operational Competencies (continued)

High 1 2 3 4 5 Low

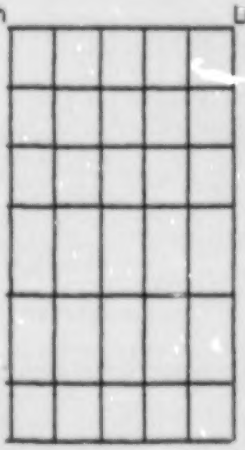
14. Introduction to and the uses of the planetarium
15. General maintenance of laboratory equipment
16. Use of the metric system
17. Models (e.g. of the solar system, parts of organisms, etc.)
18. Group discussions
19. Use of histograms
20. Electrical circuits and batteries
21. Preparing solutions of known concentration



PROCESS COMPETENCIES

High Low

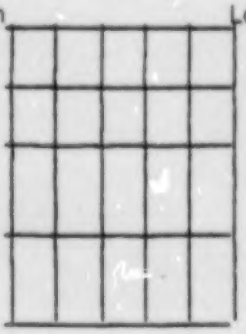
1. Questioning technique
2. Formulating hypotheses
3. Defining and delineating a scientific problem
4. Planning experiments by identifying and controlling the variables
5. Collect data by observing, identifying sources of error, and interpreting data
6. Organization of data tables for interpretation



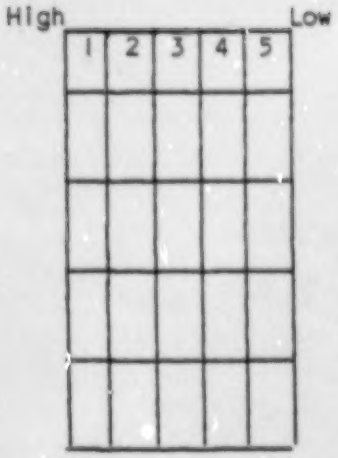
MANAGEMENT COMPETENCIES

High Low

1. Organization and execution of field trips
2. Managing the classroom
3. Use of teacher aides, student teachers, student assistants in the classroom
4. Locating and using resource people, materials in the community

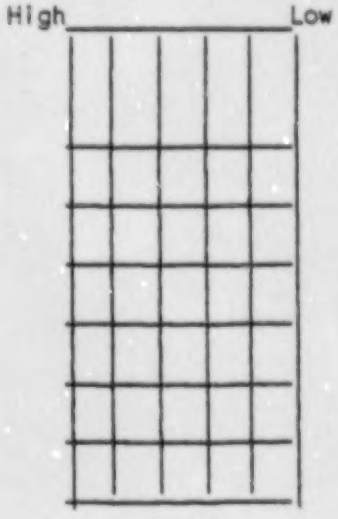


DEVELOPMENTAL COMPETENCIES



1. Writing objectives in measurable terms for elementary science lessons
2. Planning and conducting demonstrations with a hands on approach
3. Designing the materials and conducting individualized learning
4. Construction, procurement and improvement of low-budget and homemade equipment

EVALUATION COMPETENCIES



1. Evaluation of student progress in the laboratory using skills tests and observational checklists
2. Use of student feedback instruments
3. Video tape technique
4. Audio tape technique
5. Parental feedback
6. Faculty, staff and others-feedback
7. Administrative evaluation

APPENDIX D

WICHITA PUBLIC SCHOOLS
Educational Services Building
640 North Emporia
WICHITA, KANSAS 67214
August 9, 1982

Division of Research, Planning
and Development Services

Mr. Henry Donaldson
7677 East 21st Street, Apt. 1809
Wichita, Kansas 67206

Dear Mr. Donaldson:

Thank you for your telephone call expressing interest in conducting educational research in the Wichita Public Schools. Research surveys in the Wichita Public Schools are subject to the approval of the Research Council which consists of eight members of the Superintendent's Cabinet. Enclosed is a copy of Board Policy F9030.00 "RESEARCH PROJECTS" and Guidelines for Protection of Human Subjects." Research candidates are required to submit the following for consideration of the Research Council:

1) Completed "Request for Research Approval and Agreements" (enclosed)
2) Copy of any survey instruments that will be used in conducting the research
3) Copy of proposal abstract or prospectus, if applicable
4) Letter of endorsement from your college Dean

I am looking forward to meeting you and hearing about your project on Thursday, August 12, in my office at 9 a.m., 640 North Emporia, Room 206. You may want to bring your completed form and survey instruments when you come for the interview. The next meeting of the Research Council is scheduled for August 25. Should it be determined in our interview of August 12 that your project meets the criteria of the Research Council, it may be that you will want to schedule a time to meet with the Council on August 25. We would need your completed form and other documents by August 18, so that Council members can have the opportunity to review your proposal prior to the August 25 meeting.

Sincerely,

A. W. Dirks

A. W. Dirks, Chairperson
Research Council

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WICHITA PUBLIC SCHOOLS
Educational Services Building
640 North Emporia
WICHITA, KANSAS 67214
August 20, 1982

Division of Research, Planning and Development Services

TO: Research Council Members
Dr. Alvin E. Morris
Dr. Dean R. Stucky
Dr. Lawrence Bechtold
Dr. Keith Esch
Dr. David McElhinny
Dr. Ralph Walker
Dr. Donald Younglund

FROM: Bill Dirks, Research Council Chairperson

SUBJECT: Research Council Meeting - August 25, 1982

The next scheduled meeting of the Research Council is Wednesday, August 25, 1982, from 1:30 to 3:00 p.m., in Room 401 of the Educational Services Building, 640 North Emporia. Research proposals from each candidate are enclosed for your review prior to the meeting.

AGENDA

1:30 p.m. Donnie Lawrence, Doctoral Degree Candidate
School of Education, University of Kansas (Lawrence)

2:00 p.m. Henry C. Donaldson, Doctoral Degree Candidate
College of Education, Kansas State University (Manhattan)

2:30 p.m. Leslie Rohr and Iona Beden, IEP Teachers, USD 259
Griffith School and Wichita Area Vo-Tech. School

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enc.
cc: Candidates

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RESEARCH PROPOSAL

Investigator(s): Henry C. Donaldson

Date: 8/12/82

Mailing Address: 7677 E. 21st Apt. 1809
Wichita, Kansas 67206

Telephone: 685-3675

Company, University/College/School, Department:

Kansas State University

Complete this form using brief, concise statements and send one copy to the Director of Research, Planning, and Development Services, Wichita Public Schools, USD 259, for approval of the Research Council. The investigator agrees to deposit a copy of the written report or abstract of research findings in the Office of the Director of Research, Planning, and Development Services, Wichita Public Schools, upon completion of the study.

1. Title and brief description of the proposed study:
   A STUDY TO DETERMINE THE EXTENT OF AGREEMENT BETWEEN SCIENCE EDUCATORS AND SELECTED FOURTH, FIFTH, AND SIXTH GRADE TEACHERS OF SCIENCE IN KANSAS IN REGARD TO THE LABORATORY TEACHING COMPETENCIES THAT SHOULD BE POSSESSED BY THESE TEACHERS

2. Statement of the educational problem:
   This study is primarily concerned with defining fourth, fifth, and sixth grade teachers competencies for science teaching. Their opinions regarding the most appropriate laboratory competencies in the science program is considered in this study.

3. Specific purposes and expected outcomes (hypotheses to be tested may be stated):
   The null hypothesis shall be: There is no significant relationship in the extent of agreement between science educators and selected fourth, fifth, and sixth grade teachersof science in Kansas in regard to the laboratory teaching competencies that should be possessed by these teachers.

4. Description of sample needed; administrators, teachers, pupils, and/or others to be contacted; school(s) desired; and/or class(es) to be involved:

   The sample needed will be: 20 randomly selected 4th grade teachers
   20 randomly selected 5th grade teachers
   20 randomly selected 6th grade teachers

5. Expected starting date, duration of study, and expected date of final report:

   9/1/82 - 9/15/82 Date questionnaire will be sent and allowable time for late returns.

   Study should be completed by May of 1983.

RESEARCH OFFICE USE
Date Research Completed
Date Report Filed

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WICHITA PUBLIC SCHOOLS
Educational Services Building
640 North Emporia
WICHITA, KANSAS 67214
August 25, 1982

Division of Research, Planning, and Developmental Services
(316) 268-7882

Mr. Henry C. Donaldson
7677 East 21st, Apt. 1809
Wichita, Kansas 67206

Dear Mr. Donaldson:

I am pleased to confirm the Research Council's approval of your research proposal entitled *A Study to Determine the Extent of Agreement Between Science Educators and Selected Fourth, Fifth, and Sixth Grade Teachers of Science in Kansas in Regard to the Laboratory Teaching Competencies That Should Be Possessed By These Teachers*, for completing requirements toward your doctoral degree at Kansas State University (Manhattan). Your population sample will consist of 20 randomly selected fourth, 20 randomly selected fifth, and 20 randomly selected sixth grade teachers of elementary science in the Wichita Public Schools.

When you are ready to conduct your survey, please contact Mr. John Bobula, Coordinator of Science Education, 640 North Emporia (Phone: 268-7765), who will work with you in finalizing arrangements with appropriate school principals and teachers. When you have completed your thesis, please forward a copy (it does not have to be bound) to Dr. Bill Dirks, Director, Research, Planning, and Development Services, 640 North Emporia (67214). Your thesis will be kept on file and will be available to interested school and community people on a check out basis.

I am happy we could be of assistance to you. If we can be of further assistance to you on this project or in future research endeavors, please let us hear from you.

Sincerely,

A. W. Dirks

A. W. Dirks, Chairperson
Research Council

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enc. (1)
cc: Dr. Lawrence Bechtold, Director, Curriculum Services
Mr. John Bobula, Coordinator, Science Education

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6. Materials and supplies needed. How financed: Personal, company, university, college/school, department?

Item(s) Paper	Estimated Cost	Account of Personal
Total	$12.00	

7. Procedures and methods to be employed. (What will be done by the investigator and the participants in the study, data to be gathered, data-gathering instruments to be used.) If possible, attach copies of instruments to be used in obtaining data.
A questionnaire will be sent to 20 randomly selected 4th, 20 randomly selected 5th, and 20 randomly selected 6th grade teachers.

8. Data treatment and analysis:
The information on the questionnaire will be key punched on computer cards. Once this is done, the researcher proposes to use the SPSS to have the computer read the program. A chi square measurement will be used in analyzing the data using a 2x5 matrix.

9.. Protection of human subjects:

a.	Rights of privacy guaranteed	Yes	X	No ____
b.	Permission for participation on record	Yes	X	No ____
c.	Clearance by company, university/college/school	Yes	X	No ____

Approval		Date
Research Council Chairperson	R.W. Clarks	8/25/82
Superintendent	Alvin E. Morris	8/25/82
Deputy Superintendent	[illegible]	"
Director, Elementary Education	Ralph E. Walker	8/25/82
Director, Secondary Education	J. D. McC	"
Director, Curriculum Services	Laurence A. Bartlett	8/25/82
Director, Personnel Services	C. Kyle Lack	8-25-82
Director, Pupil Services	Donald E. Youngblood	8/25/82

RESEARCH, PLANNING, AND DEVELOPMENT SERVICES DIVISION - GENERAL

P9030.00 RESEARCH PROJECTS

BOARD POLICY:

RESEARCH PROJECTS ARE ENCOURAGED FOR THE PURPOSE OF IMPROVING EDUCATIONAL PRACTICES. SUCH PROJECTS ARE MONITORED BY THE RESEARCH, PLANNING, AND DEVELOPMENT SERVICES DIVISION UNDER GUIDELINES ESTABLISHED BY THE RESEARCH COUNCIL.

Administrative Implemental Procedures:

1. Any project that deviates significantly from the regular organizational and instructional program must be approved. Examples are as follows:

   a. Any graduate study.

   b. A project involving more than one school.

   c. A project involving personnel other than the investigator.

   d. A project utilizing confidential records.

   e. A project requiring expenditures from Board of Education funds.

2. Research proposals should meet the following criteria:

   a. Offer promise of improving educational practices.

   b. Show evidence of careful planning, including a review of current literature, if appropriate.

   c. Be planned in advance so as to minimize interruptions in the regular school program and conflicts with scheduled school events. Generally, requests to gather data during the regular school term must be scheduled between September 15 and May 1.

   d. Conform to the values and standards of the school and community.

   e. Pertain to a relevant educational problem, contain an appropriate research design, and spell out procedures clearly.

   f. Make no undue demands upon the time of pupils and staff.

   g. Respect the confidentiality of personal data concerning pupils and employees.

   h. Respect the right of individuals to refrain from participation on research studies.

(over)

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i. Involve, generally, graduate level research or its equivalent. Normally, requests by undergraduate college students will not be approved.

3. The investigator is responsible for fulfilling the following requirements:

a. Confer with the appropriate Research Council member before submitting a request. Provisions for financing projects should be made at this time if expenditures from Board of Education funds are anticipated.

b. Submit copies of a detailed description of the proposed project to the Director of Research, Planning, and Development Services Division.

c. Secure Research Council approval of the proposal before collecting the data.

d. File a progress report with the Research, Planning, and Development Services Division at the end of each school year for an incomplete study.

e. Deposit a copy of the written report or summary of the study in the Research, Planning, and Development Services Division upon completion of the study.

4. The school district is responsible for the following:

a. Provide an initial conference between the investigator and appropriate Research Council members.

b. Evaluate proposals. Research Council members may study proposals individually, or the council may meet as a group to consider proposals. Persons submitting proposals may be requested to meet with the council or to provide additional information.

c. Assist in changing the design or procedures if requested.

d. Approve requests, subject to defined conditions or limitations.

e. Deny requests if the Research Council feels that it would be inappropriate to have such studies conducted in the Wichita Public Schools.

f. Notify candidates regarding acceptance or rejection of requests.

(more)

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g. Assist in the conduct of studies.

h. Maintain file copies of written reports or summaries of research studies for a minimum of three years.